PM-9000 Express

Portable Multi-parameter Patient Monitor

Service Manual

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Mindray is responsible for safety, reliability and performance of this equipment only in the condition that:

- all installation, expansion, change, modification and repair of this equipment are conducted by Mindray qualified personnel;
- applied electrical appliance is in compliance with relevant National Standards;
- the monitor is operated under strict observance of this manual.

⚠ Warning ⚠

For continued safe use of this equipment, it is necessary that the listed instructions are followed. However, instructions listed in this manual in no way supersede established medical practices concerning patient care.

- **Do not rely only on audible alarm system to monitor patient. When monitoring adjusting the volume to very low or completely muting the sound may result in the disaster to the patient. The most reliable way of monitoring the patient is at the same time of using monitoring equipment correctly, manual monitoring should be carried out.**
- **This multi-parameter patient monitor is intended for use only by medical professionals in health care institutions.**
- **To avoid electrical shock, you shall not open any cover by yourself. Service must be carried out by qualified personnel.**
- **Use of this device may affect ultrasonic imaging system in the presence of the interfering signal on the screen of ultrasonic imaging system. Keep the distance between the monitor and the ultrasonic imaging system as far as possible.**
- **It is dangerous to expose electrical contact or applicant coupler to normal saline, other liquid or conductive adhesive. Electrical contact and coupler such as cable connector, power supply and parameter module socket-inlet and frame must be kept clean and dry. Once being polluted by liquid, they must be thoroughly dried. If to further remove the pollution, please contact your biomedical department or Mindray.**

It is important for the hospital or organization that employs this equipment to carry out a reasonable maintenance schedule. Neglect of this may result in machine breakdown or injury of human health.

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- the PM-9000 is not used in accordance with the instructions for use, or the electrical installation of the relevant room does not comply with NFPA 70: National Electric Code or NFPA 99: Standard for Health Care Facilities (Outside the United States, the relevant room must comply with all electrical installation regulations mandated by the local and regional bodies of government).

Return Policy

Return Procedure

In the event that it becomes necessary to return a unit to Mindray, the following procedure should be followed:

1. Obtain return authorization. Contact the Mindray Service Department and obtain a Customer Service Authorization (Mindray) number. The Mindray number must appear on the outside of the shipping container. Return shipments will not be accepted if the Mindray number is not clearly visible. Please provide the model number, serial number, and a brief description of the reason for return.

2. Freight policy. The customer is responsible for freight charges when equipment is shipped to Mindray for service (this includes customs charges).

Company Contact

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Safety Precautions

1 . Meaning of Signal Words

In this manual, the signal words **DANGER**, **WARNING**, and **CAUTION** are used regarding safety and other important instructions. The signal words and their meanings are defined as follows. Please understand their meanings clearly before reading this manual.

Signal word	Meaning
⚠**DANGER**	**Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.**
⚠**WARNING**	**Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**
⚠**CAUTION**	**Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.**
CAUTION	Indicates a potentially hazardous situation which, if not avoided, may result in property damage.

2 . Meaning of Safety Symbols

Symbol	Description
	Type-BF applied part
	"Attention" (Refer to the operation manual.)

3 . Safety Precautions

Please observe the following precautions to ensure the safety of service engineers as well as operators when using this system.

⚠**DANGER:** **Do not use flammable gasses such as anesthetics, or flammable liquids such as ethanol, near this product, because there is danger of explosion.**

⚠WARNING: **Do not connect this system to outlets with the same circuit breakers and fuses that control current to devices such as life-support systems. If this system malfunctions and generates an overcurrent, or when there is an instantaneous current at power ON, the circuit breakers and fuses of the building's supply circuit may be tripped.**

⚠CAUTION:

1. **Malfunctions due to radio waves**

   (1) Use of radio-wave-emitting devices in the proximity of this kind of medical electronic system may interfere with its operation. Do not bring or use devices which generate radio waves, such as cellular telephones, transceivers, and radio controlled toys, in the room where the system is installed.

   (2) If a user brings a device which generates radio waves near the system, they must be instructed to immediately turn OFF the device. This is necessary to ensure the proper operation of the system.

2. **Do not allow fluids such as water to contact the system or peripheral devices. Electric shock may result.**

Symbols

Be Careful

Protective earth ground

Indicates that the instrument is IEC-60601-1 Type CF equipment. The unit displaying this symbol contains an F-Type isolated (floating) patient applied part providing a high degree of protection against shock, and is suitable for use during defibrillation.

Equipotential grounding terminal

CE mark 93/42/EEC a directive of the European Economic Community

Silence Symbol

! Close all alarm volume

@ Mark Event

》 Next menu

*** Highest level alarm

** Middle level alarm

* Lowest level alarm

Alarm pause

Trend graph cursor

 SYS pressure（NIBP trend graph）

 DIA pressure(NIBP trend graph)

* MEAN pressure (NIBP trend graph)

Right moving indicator

Left moving indicator

Heart beat

 Pace signal

× Gain magnify

√ Confirm

SN Series Number

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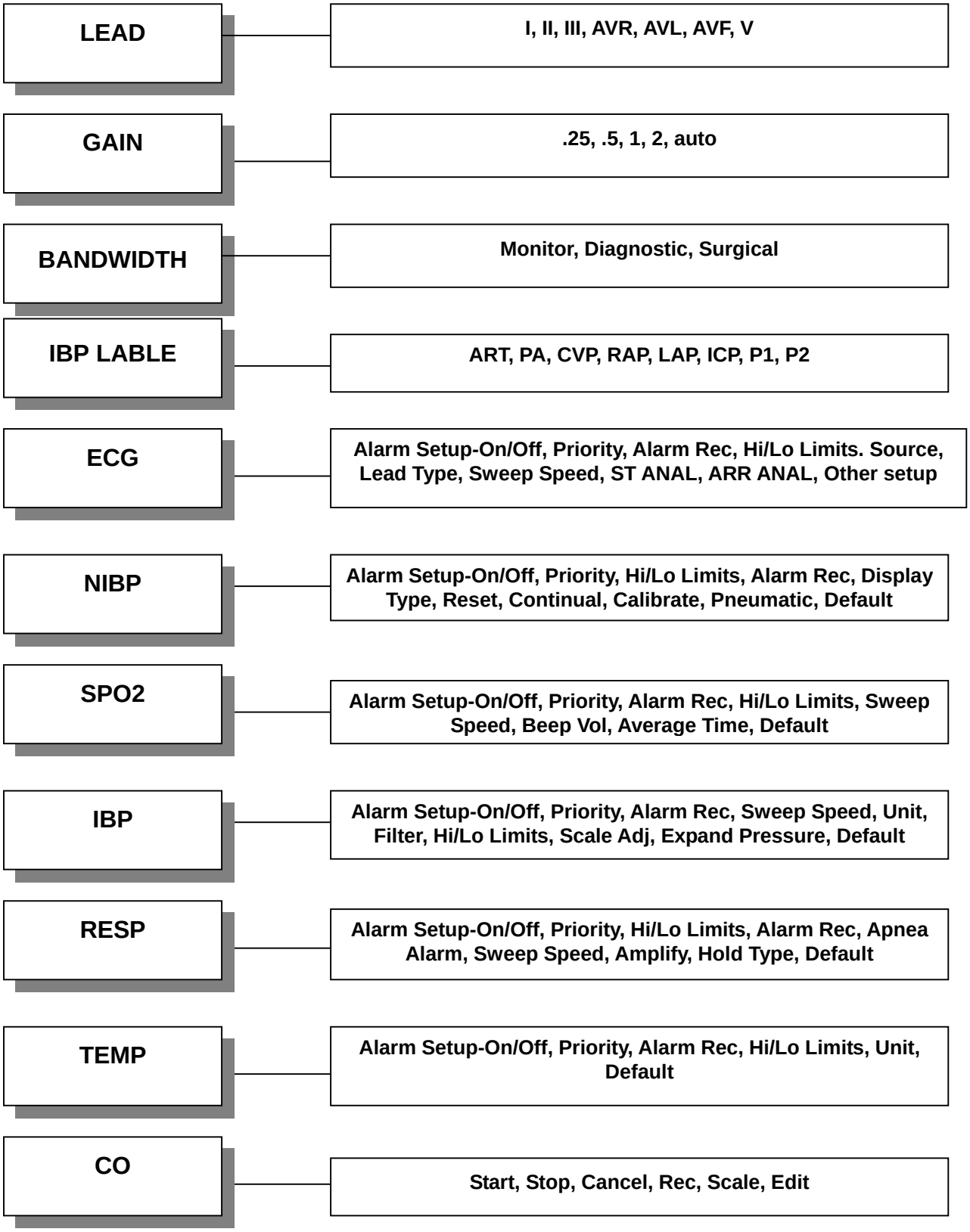
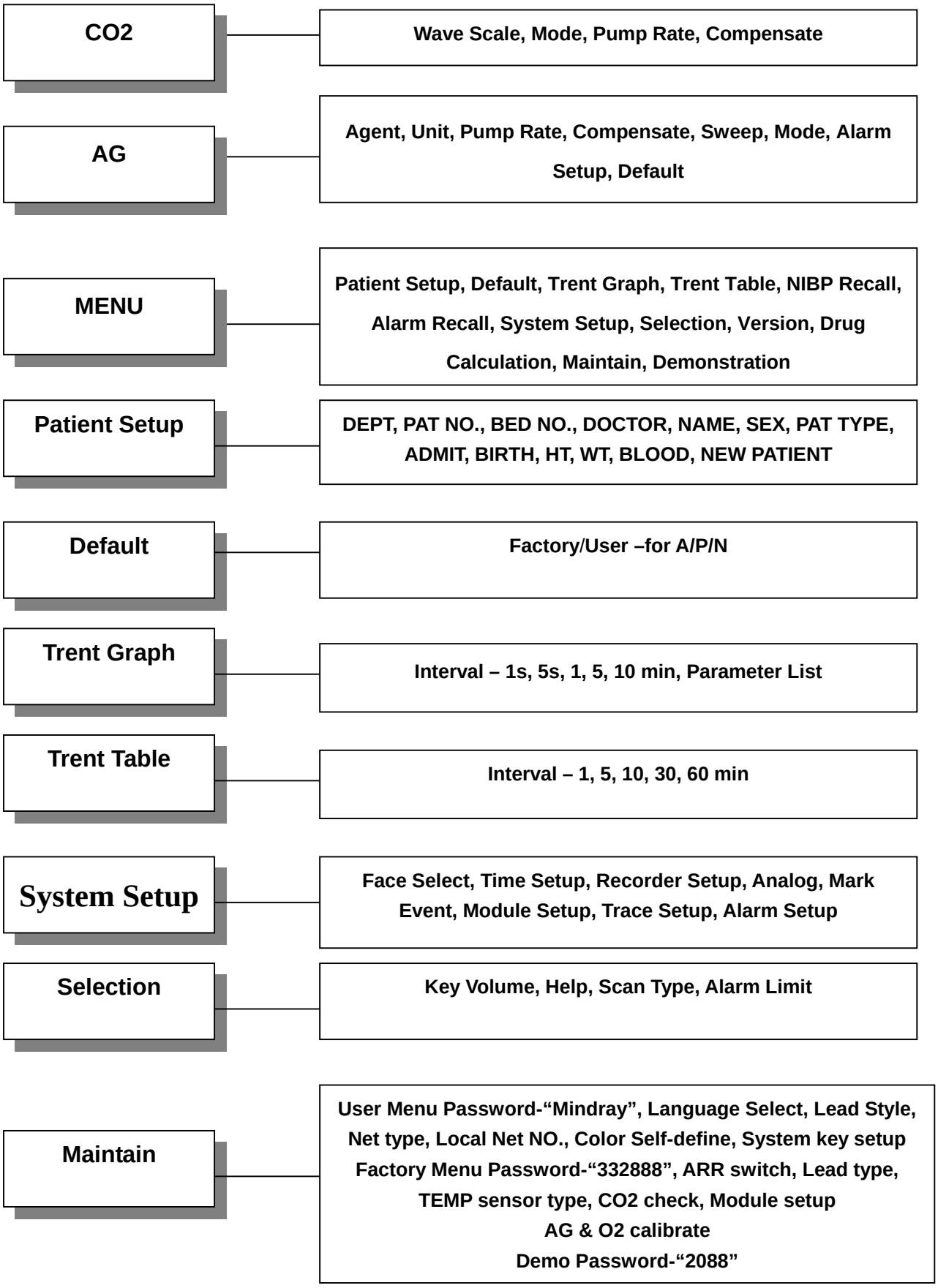
Chapter 1 Menu Tree


LEAD
I, II, III, AVR, AVL, AVF, V
GAIN
.25, .5, 1, 2, auto
BANDWIDTH
Monitor, Diagnostic, Surgical
IBP LABLE
ART, PA, CVP, RAP, LAP, ICP, P1, P2
ECG
Alarm Setup-On/Off, Priority, Alarm Rec, Hi/Lo Limits. Source, Lead Type, Sweep Speed, ST ANAL, ARR ANAL, Other setup
NIBP
Alarm Setup-On/Off, Priority, Hi/Lo Limits, Alarm Rec, Display Type, Reset, Continual, Calibrate, Pneumatic, Default
SPO2
Alarm Setup-On/Off, Priority, Alarm Rec, Hi/Lo Limits, Sweep Speed, Beep Vol, Average Time, Default
IBP
Alarm Setup-On/Off, Priority, Alarm Rec, Sweep Speed, Unit, Filter, Hi/Lo Limits, Scale Adj, Expand Pressure, Default
RESP
Alarm Setup-On/Off, Priority, Hi/Lo Limits, Alarm Rec, Apnea Alarm, Sweep Speed, Amplify, Hold Type, Default
TEMP
Alarm Setup-On/Off, Priority, Alarm Rec, Hi/Lo Limits, Unit, Default
CO
Start, Stop, Cancel, Rec, Scale, Edit


CO2
Wave Scale, Mode, Pump Rate, Compensate
AG
Agent, Unit, Pump Rate, Compensate, Sweep, Mode, Alarm Setup, Default
MENU
Patient Setup, Default, Trent Graph, Trent Table, NIBP Recall, Alarm Recall, System Setup, Selection, Version, Drug Calculation, Maintain, Demonstration
Patient Setup
DEPT, PAT NO., BED NO., DOCTOR, NAME, SEX, PAT TYPE, ADMIT, BIRTH, HT, WT, BLOOD, NEW PATIENT
Default
Factory/User –for A/P/N
Trent Graph
Interval – 1s, 5s, 1, 5, 10 min, Parameter List
Trent Table
Interval – 1, 5, 10, 30, 60 min
System Setup
Face Select, Time Setup, Recorder Setup, Analog, Mark Event, Module Setup, Trace Setup, Alarm Setup
Selection
Key Volume, Help, Scan Type, Alarm Limit
Maintain
User Menu Password-“Mindray”, Language Select, Lead Style, Net type, Local Net NO., Color Self-define, System key setup
Factory Menu Password-“332888”, ARR switch, Lead type, TEMP sensor type, CO2 check, Module setup
AG & O2 calibrate
Demo Password-“2088”

Chapter 2 Introduction

2.1 General

PM-9000 EXPRESS is a Portable Patient Monitor that has abundant monitoring functions and is used for the clinical monitoring of adult, pediatric and neonate. In addition, the user may select the different parameter configuration according to different requirements.

PM-9000 EXPRESS can be connected to the central monitoring system via the Mindray network so as to form a network monitoring system.

PM-9000 EXPRESS (Figure 2-1) can monitor vital signals as ECG, Respiratory Rate, SpO2, NIBP, Dual-channel TEMP, Dual-channel IBP, CO, CO2 and AG. It integrates parameter measuring modules, display and recorder in one device, featuring in compactness, lightweight and portability. Replaceable built-in battery facilitates transportation of patient. Large high-resolution display provides clear view of 8 waveforms and full monitoring parameters.

The POWER switch is on the bottom left quarter of the front panel (① in Figure 2-1). The CHARGE indicator on the right side of the POWER switch lights when the device is powered on (② in Figure 2-1). The ALARM indicator is on the upper side of the front panel. The ALARM indicator flashes when alarm occurs (③ in Figure 2-1). The sockets of the sensors are at the left side. The recorder socket is at the right side. Other sockets and power plug-in are at the rear panel.

PM-9000 EXPRESS has a very friendly operation interface for the users, and you can finished all the operations via a few buttons (④)and a rotary knob(⑤)on the front panel.

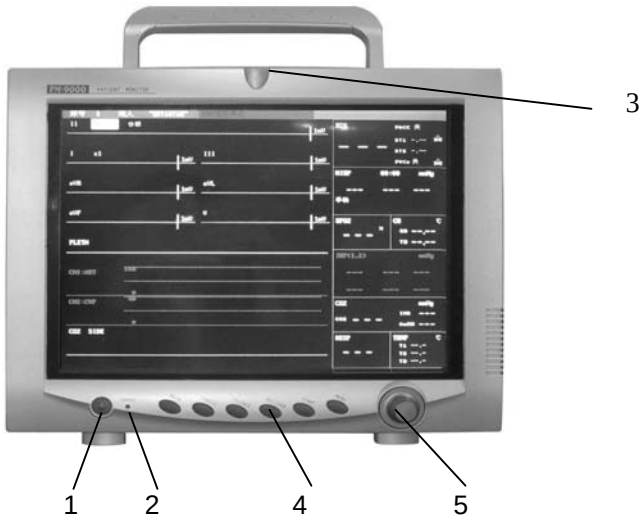


Figure 2-1 PM-9000 EXPRESS Portable Patient Monitor

PM-9000 EXPRESS portable patient monitor performs monitoring of:

ECG	Heart Rate (HR) 2-channel ECG waveforms Arrhythmia and S-T segment analysis（optional）
RESP	Respiratory Rate (RR) Respiration Waveform
SpO2	Oxygen Saturation (SpO2), Pulse Rate (PR) SpO2 Plethysmogram
NIBP	Systolic Pressure (NS), Diastolic Pressure (ND), Mean Pressure (NM)
TEMP	Channel-1 Temperature (T1), Channel-2 Temperature (T2), Temperature Difference between two channels (TD)
IBP	Channel-1 SYS, DIA, MAP Channel-2 SYS, DIA, MAP Dual-IBP waveforms
CO	Blood Temperature (TB) Cardiac Output (CO)
CO2	End Tidal CO2 （EtCO2） Inspired Minimum CO2 (InsCO2) Air Way Respiration Rate (AwRR)
AG	EtCO2 Nitrous oxide (N_2O) 5 Agent gases O_2 (optional function) Respiring time per minute (AwRR)

PM-9000 EXPRESS provides extensive functions such as visual & audible alarm, storage and report printout of trend data, NIBP measurements, and alarm events, OxyCRG review and drug dose calculation.

2.2 Screen Display

The display of PM-9000 EXPRESS parameter monitor is a color LCD, which can display the collected patient parameters, waveforms, alarm information as well as bed number, time and monitor status, etc.

The screen is divided into three areas(Figure 2-2): Information area①④, waveform area② and parameter area③.

Figure2-2 PM-9000 EXPRESS Main Screen

Information Area(①):

Information area lies on the top part of the screen, which is used to display the current status of the monitor and the patient. The information area contains following data:

Bed No.: used to indicate the bed number of the patient being monitored.

Adult: used to indicate the patient type.

3/1/2001: used to indicate the current date.

10:23:45: used to indicate the current time.

Patient sex: Patient gender. Displayed to the right side of the patient name.

Other information displayed in the information area appears or disappears together with the status being reported, which are divided into following parts based on the contents:

- Monitor Prompt Information: Informing the status of monitor or sensor, which always appears to the right side of the time. When this information appears, it will cover the patient sex and name.
- "🔇" is the SILENCE mark. When pressing SILENCE button, this mark appears, indicating that all kinds of sound are manually muted. The system gives out the sound only after the operator discharge the SILENCE status or the system has new alarm event.
- "！🔇" is the mark indicating that the alarm volume is closed. When select the "OFF" item in the USER MAINTAIN menu, this mark appears indicating that the operator has permanently closed the audio alarm function. This audio alarm function can resume only after the operator discharges the closing alarm volume setup.
- Patient parameter alarm information: this information is fixedly displayed in the extreme right side of the screen.
- When the waveform on the screen is frozen, the corresponding prompt "FROZEN" window appears on the bottom part of the screen.

Waveform / Menu Area(②)

The waveform area can maximally display 8 waveforms. The displaying order of the waveforms on the screen can be adjusted. For the maximum configuration, the waveforms provided by the system for selection are: 2 ECG waveforms, SpO2 waveform, 2 IBP waveforms, RESP waveform, CO2 waveform, O2 waveform and AG waveform.

All the waveforms in the system are listed out in the “WAVEFORM SETUP” menu. The user may select the waveform to be displayed and adjust their displaying positions. The specific method is illustrated in the part: Set Up Screen Waveform.

The name of the waveform is displayed on the upper left part of the waveform. The user may choose ECG lead based on the requirements. The gain and the filter of the channel are also displayed on each ECG waveform. A 1mV scale bar is also displayed to the right side of ECG waveform. The IBP waveform scale can also be selected according to the actual requirement. Its range is described in the part: Measure IBP. In the IBP waveform area, the waveform scale is displayed. The three dotted lines for each IBP waveform form up to down represent respectively the upper limit scale, reference scale and lower limit scale. The values of these three scales can be set. The specific method is given in the part: Measure IBP.

When wanted during screen operation, the menu always occupies the fixed position in the middle part of the waveform area, therefore part of waveform can not be viewed temporarily. After exiting the menu, the system will restore the original screen.
The user may set up the rate to refresh the waveform. The method to adjust the refreshing rate of each waveform is discussed in the setup description of each parameter.

Parameter Area(③)

The parameter area lies to the right side of the waveform area, whose position basically corresponds to the waveform. The parameters displayed in the parameter area include:

ECG

- Heart rate or pulse rate (unit: beats/minute)
- The ST analyzing result of channel 1 and 2: ST1, ST2 (unit: mV)
- PVCs（unit: times/minute）

NIBP

- From left to right, there are Systolic pressure, Mean pressure and Diastolic pressure（unit: mmHg or kPa）

SpO_2

- SpO_2（unit: %）
- Pulse Rate（unit: beats/minute）（When “BOTH” item is selected）

CO

— CO（unit: liter/minute）
— TB（unit: ℃ or ℉）

IBP

— The blood pressure of channel 1 and 2. From left to right, there are Systolic pressure, Mean pressure and Diastolic pressure（unit: mmHg or kPa）.

RESP

— Respiration Rate（unit: times/minute）

CO2

— EtCO2（unit: mmHg or kPa）
— INS CO2 (unit: mmHg or kPa)
— AwRR (times/minute)

TEMP

— Temperature of channel 1 and 2: T1, T2 and the difference between them TD. (unit: ℃ or ℉)

AG

— EtCO2 (CO2)
— Nitrous Oxide (N2O)
— Oxygen (O2) (optional function)
— Respiring Time per Minute (AwRR)
— Anaesthetic agent

Alarm lamp and alarm status:

In normal status: the alarm lamp is not on.

When alarm exists, the alarm lamp flashes or lights on. The color of the lamp corresponds to the alarm level.

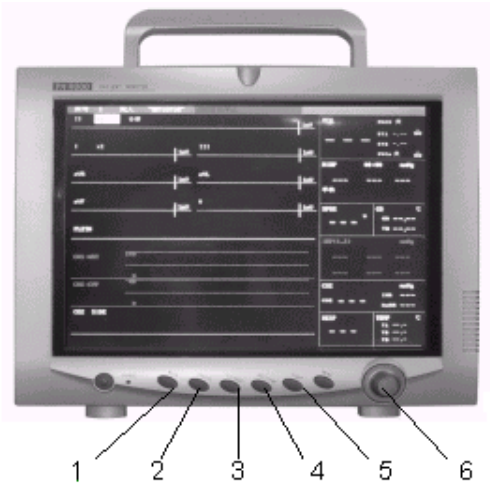


Figure 2-3 PM-9000 EXPRESS buttons and knob

2.3 Button and knob Functions

All the operations to PM-9000 EXPRESS are through the buttons and a knob at the bottom of the screen.

MAIN(Figure 2-3 ①)

Whatever levels of menu the system is in, press the button and the system will always return to the main screen.

FREEZE(Figure 2-3 ②)

Press this button and the system will access the FREEZE status. In this status the user may review the waveform of 40 seconds. Also, the frozen waveform can be printed out. In the FREEZE status, press this button again to discharge the FREEZE status. For detailed information, refer to related chapter: Freeze.

SILENCE(Figure 2-3 ③)

Press this button and the system will access the Alarm Pause status. All the alarm sounds are muted. However, other sounds such as heart beat, button sound and pulse sound will still exist. At this time, the “ALARM PAUSE xx s” appears in the parameter alarm information area. Press this button again or when the pause time runs out, the system terminates the alarm pause status and returns to the normal monitoring status, then the alarm sound resumes and the prompt “ALARM PAUSE xx s” disappears from the screen. What’s more, pressing this button more than 1 second will mute the sound.

REC/STOP(Figure 2-3 ④)

Press to start a real time recording. The recording time is set in REC TIME of RECORD SETUP submenu. Press this button during recording to stop the recording. In Freeze mode, the user may use(press) this button to select the waveform to be output. For detailed information, refer to related chapter.

NIBP(START) (Figure 2-3 ⑤)

Press to inflate the cuff to start a blood pressure measurement. In the process of measuring, pressing this button can cancel the measurement and deflate the cuff.

Rotary knob (Figure 2-3 ⑥)

The user may use the rotary knob to select the menu item and modify the setup. It can be rotated clockwise or counter-clockwise and pressed like other buttons. The user may use the knob to realize the operations on the screen and in the system menu and parameter menu.

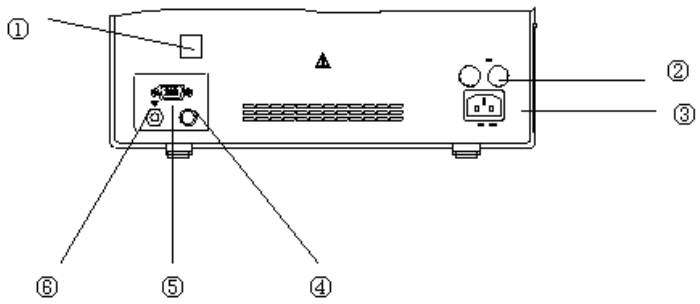


Figure 2-4 PM-9000 EXPRESS rear panel

- Network Interfaces (Socket ①): Standard RJ45 Socket.
- FUSE (Socket ②) Standard T 1.6A
- Power Supply(Socket ③): External 100-250 (VAC), 50/60 (Hz).
- ANALOG OUTPUT or AUX OUTPUT(Socket ④)
  ANALOG OUTPUT is replaced by AUX OUTPUT on July 2004.
- VGA MONITOR: (Socket ⑤)
  Monitor interface for external standard VGA color monitor.
- ⏚ (Socket ⑥)
  Equipotential grounding terminal for connection with the hospital's grounding system.

Patient cables and sensor sockets are shown in the figure below;

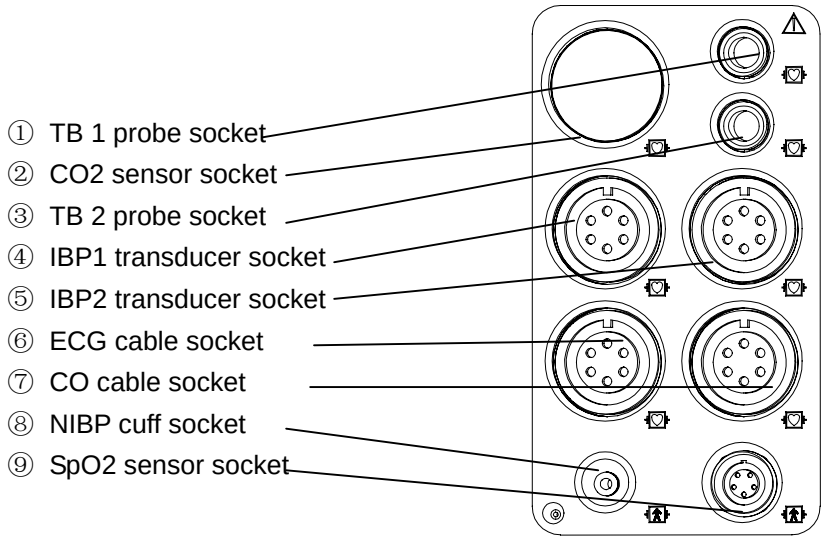

① TB 1 probe socket
② CO2 sensor socket
③ TB 2 probe socket
④ IBP1 transducer socket
⑤ IBP2 transducer socket
⑥ ECG cable socket
⑦ CO cable socket
⑧ NIBP cuff socket
⑨ SpO2 sensor socket

Figure 2-5

Chapter 3 Principle

3.1 PM-9000 block diagram

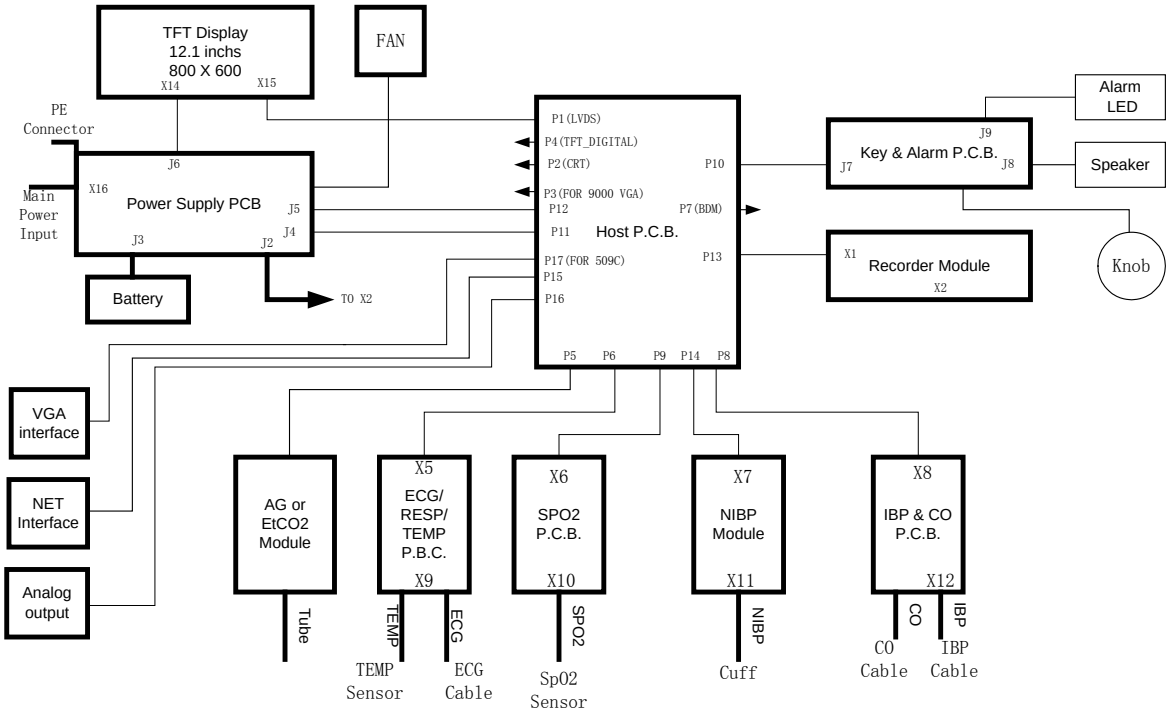


Figure 3-1 PM-9000 block diagram

3.2 PCB connection diagram

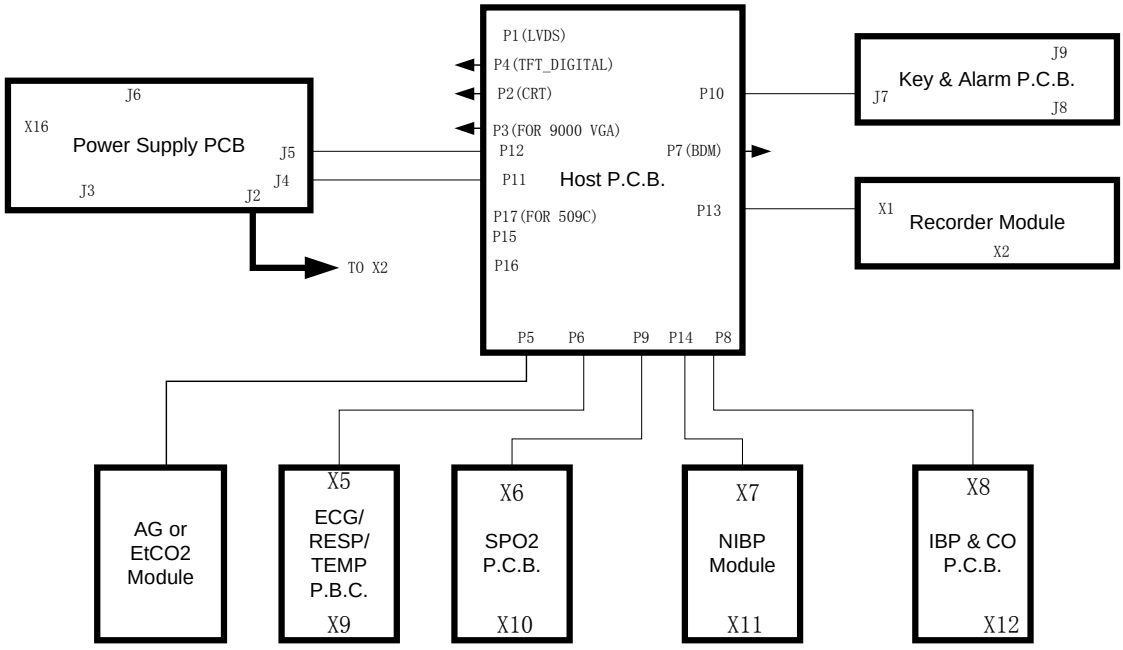


Figure 3-2 PCB connection diagram

3.3 Main Board

3.3.1 General

Main board is the most important unit of the patient monitor. It is designed to realize system control, system scheduling, system management, file management and print management as well as to finish data processing, displaying, and storage, system diagnosis and fault alarm, etc.

3.3.2 Schematic Diagram

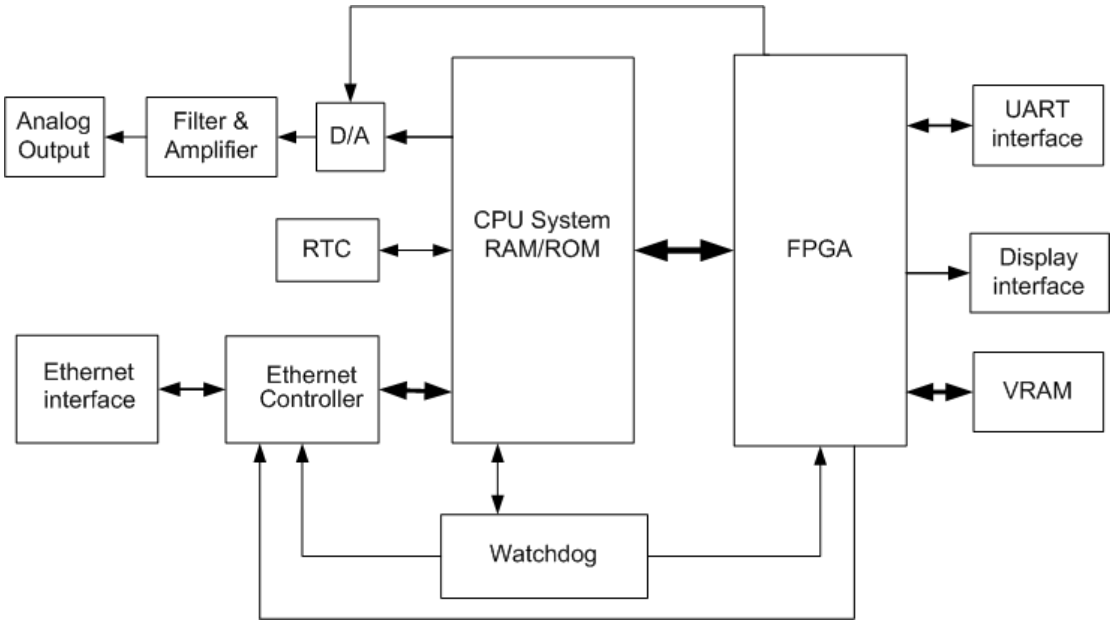


Figure 3-3 Main board

3.3.3 Introduction to Principle

The main board, being the center part of the system, has serial ports to various modules , TFT display interface, analog VGA interface, Ethernet interface and analog/aux output. The BDM interface is reserved on the board for debugging or downloading software.

CPU System

CPU is the core element on the main board. It connects peripheral modules through BUS and I/Os in order to finish data communication, data processing and logic control, etc.

RTC

RTC (real-time clock) provides time (hour, minute, second) and date (year, month, day,) information. RTC information can be changed by CPU.

Ethernet Controller

Ethernet Controller complies with IEEE802.3 / IEEE802.3u LAN standard, supports 10Mbps and 100Mbps data rates, and realizes the data communication between CPU and Ethernet.

Analog Output/AUX OUTPUT

D/A converter converts ECG or IBP digital signals coming from CPU into analog signals, which after being low-pass filtered and amplified in Filter & Amplifier circuit are output to external part. AUX OUTPUT has another function: Nurse Call. For this function, please refer to the operation manual.

FPGA and VRAM

VRAM is used to save display data. CPU sends display data to VRAM via FPGA. The data in VRAM is a map of the real display device.
FPGA has various extended serial ports, which communicate with external parameter modules. CPU writes acquired data to FPGA, and FPGA sends it to external parameter modules.

Watchdog

Upon power-up, Watchdog supplies Reset signals to CPU, FPGA and Ethernet Controller. Provide functions of Waterdog Timer Output and voltage supervise.

3.4 ECG/RESP/TEMP Module

3.4.1 General

This module is designed to measure three parameters including ECG, RESP and TEMP.

3.4.2 Schematic Diagram

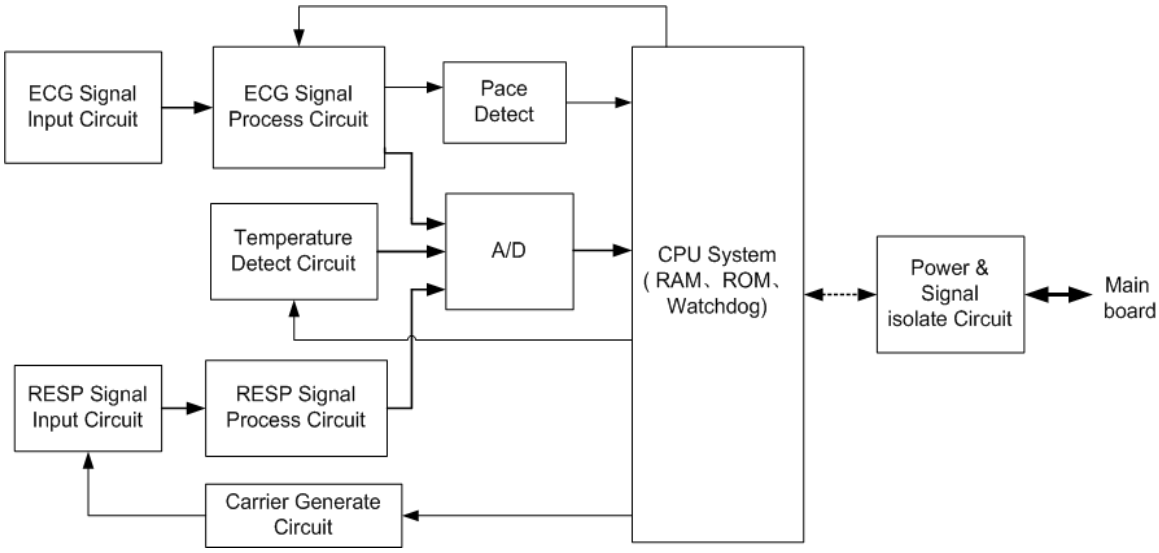


Figure 3-4 ECG/RESP/TEMP Module

3.4.3 Introduction to Principle

This module uses ECG cables and TEMP sensors to collect ECG, RESP and TEMP signals, process them and transmit them to the main board through serial port.

ECG Signal Input Circuit

Input protection and filter circuit: receives ECG signals from ECG cables, removes high-frequency interference and prevents the circuit from being damaged by high voltage generated in defibrillation and ESD.

Right leg drive circuit: picks up 50/60Hz common-mode signals in lead wire and feeds them back to patient body; suppresses the common-mode interference in lead wire for the sake of better detecting ECG signals.

Lead Off detection circuit: detects if any ECG lead falls off and transmits relevant message to CPU.

ECG Signal Process Circuit

Differential Amplification circuit: first-order amplifies ECG signals and suppresses common-mode interference at the same time.

Low-pass filter circuit: removes high-frequency interference outside frequency band of ECG signals.

PACE signals are ECG pacing signals, which greatly affect ECG detecting performance. Therefore PACE suppression circuit is designed to suppress PACE signals in order to better detect ECG signals.

Master AMP/Filter circuit: amplifies and filters ECG signals again and transmits them furthermore into A/D converter.

Pace Detect

Pick PACE signals out of ECG signals and transmit them to CPU.

Temperature Detect Circuit

Receive signals coming from TEMP sensor, amplify and filter the signals and transmit them furthermore into A/D converter.

Carrier Generate Circuit

RESP measurement is based on Impedance method. Respiration causes the changes of thoracic impedances, which feature is taken advantage to modulate the amplitude of high frequency carrier. The modulated signals are then sent into the measuring circuit. This circuit is designed to generate high frequency carrier

RESP Signal Input Circuit

Couples the RESP signals into the detection circuit.

RESP Signal Process Circuit

Preamplifier circuit: amplifies and filters RESP signals;
Detection circuit: picks out the RESP wave modulated in excitation signals;
Level translation circuit: removes DC components in RESP signals;
Master AMP/Filter circuit: amplifies and filters RESP signals again and transmits them furthermore into A/D converter.

A/D

Convert analog signals output from each parameter circuit into digital signals, and send them into CPU part to receive further processing.

CPU System

Realize logic control over all parameter parts and A/D part.
Process data of each parameter;
Communicate with main board.

Power & Signal Isolate Circuit

Realize isolation from external circuit in order to ensure human safety;
Provide power supplies for circuits;
Realize isolating communication between CPU System and main board.

3.5 CO/IBP Module

3.5.1 General

This module is designed to measure two parameters including CO and IBP.

3.5.2 Schematic Diagram

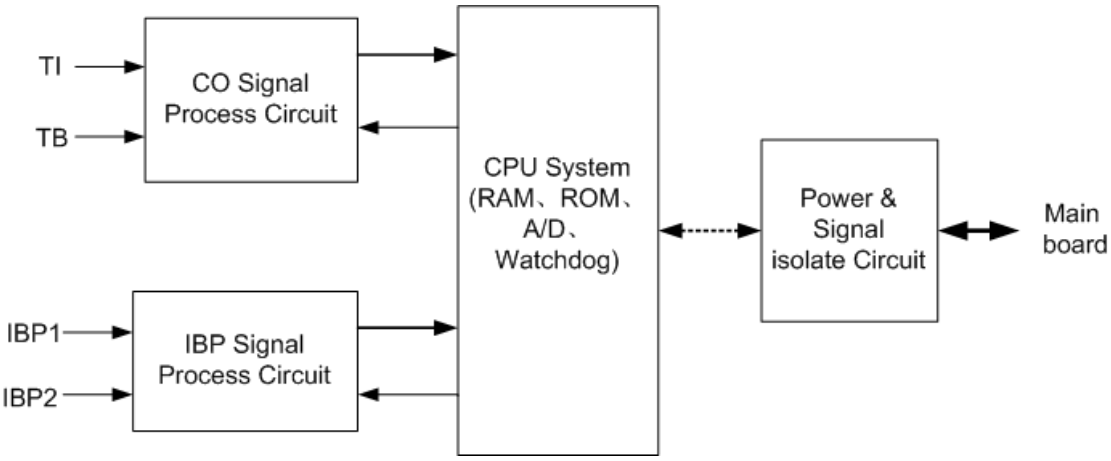


Figure 3-5 CO/IBP Module

3.5.3 Introduction to Principle

This module uses sensors to collect CO and IBP signals, processes them and transmits them into the main control board through serial port.

CO Signal Process Circuit

Thermal dilution method is adopted to measure CO. The sensor supplies two signals, TI and TB, to CO Signal Process Network. The signals are amplified, low-pass filtered and then sent to CPU System for further processing.

IBP Signal Process Circuit

IBP signals are differential signals, which, after being common-mode filtered, are amplified in differential AMP circuit. The differential signals are first changed into single ended signals, which are low-pass filtered and then sent into CPU System for further processing.

CPU System

Convert analog signals acquired by each parameter circuit into digital signals;
Realize logic control over all parameter signal processing parts;
Process data of each parameter;Communicate with main board.

Power & Signal isolate Circuit

Realize isolation from external circuit in order to ensure human safety;

Provide power supplies for circuits;

Realize isolating communication between CPU System and main board.

3.6 SPO2 Module

3.6.1General

This module is designed to measure SPO2.

3.6.2 Schematic Diagram

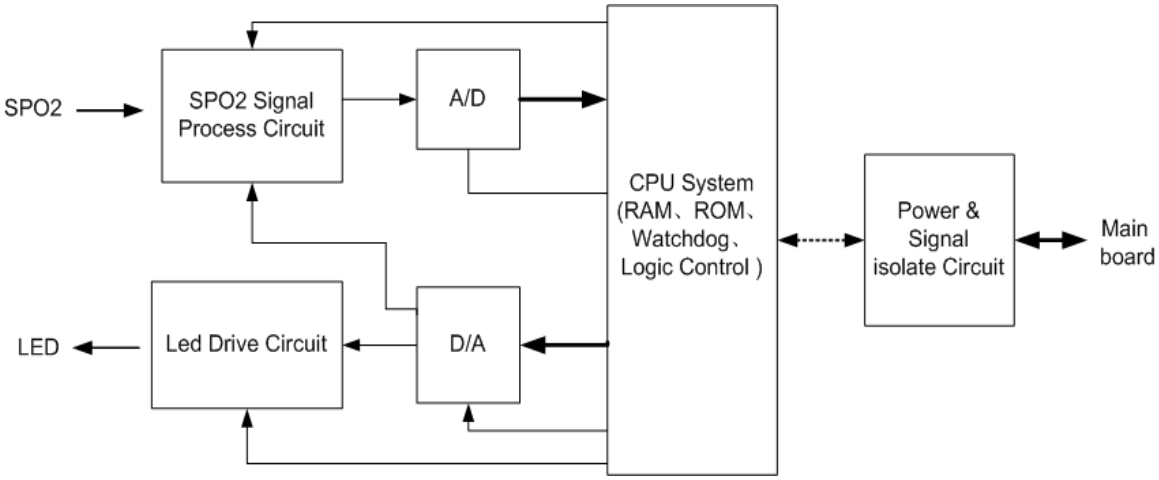


Figure 3-6 SPO2 Module

3.6.3 Introduction to Principle

Sensor is used to collect the signals of red and infrared lights having penetrated human finger or toe. Relevant unit is designed to process the acquired signals and accordingly give the result. Driving current of LED and gain of AMP circuit are controlled to fit different patients.

Led Drive Circuit

Provide driving current to LED. The driving current is adjustable.

SPO2 Signal Process Circuit

Preamplifier circuit converts photocurrent signals into voltage signals and additionally first-order amplifies them;

Gain adjustment and amplification circuit amplifies the signals and adjusts their gain;

Bias circuit adjusts the dynamic range of the signals and then sends them into A/D converter.

A/D

Convert analog signals into digital signals and send them into CPU part for further processing.

D/A

Convert digital signals output from CPU into analog signals, supply control signals to Led Drive Circuit and SPO2 Signal Process Circuit.

CPU System

Realize logic control over the whole circuit;

Process SPO2 data;

Communicate with main control board.

Power & Signal isolate Circuit

Realize isolation from external circuit in order to ensure human safety;

Provide power supplies for circuits;

Realize isolating communication between CPU System and main board.

3.7 NIBP Module

3.7.1 General

This module is designed to measure NIBP.

3.7.2 Schematic Diagram

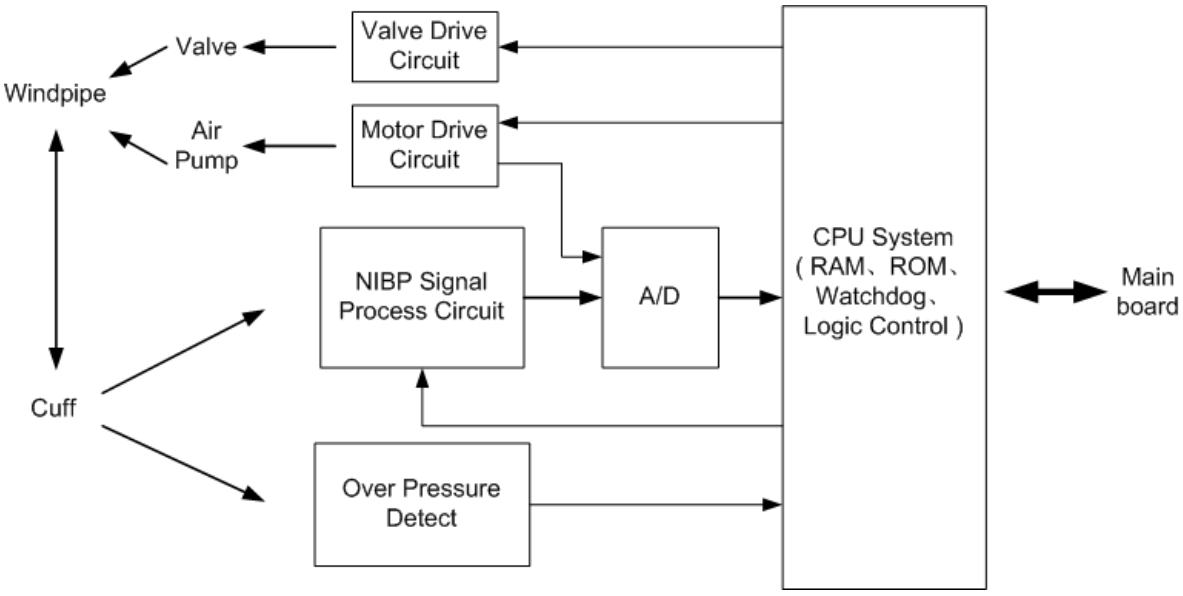


Figure 3-7 NIBP Module

3.7.3 Introduction to Principle

Oscillometric method is adopted to measure NIBP. Inflate the cuff wrapped around the upper arm until the pressure makes the blood in the artery of the upper arm stops flowing. Then deflate the cuff according to the requirement of the algorithm. Blood flow in the artery resumes as the cuff pressure decrease, which will cause corresponding pulsation in the cuff. The pressure sensor connecting the inflating hose of the cuff will accordingly generate pulsating signals. The NIBP module can process these signals and give measuring result.

Valve Drive Circuit

Control OPEN/CLOSE of the valve. This circuit, together with Motor Drive Circuit, finishes the action of inflating and deflating cuff.

Motor Drive Circuit

Control the action of air pump. This circuit, together with Valve Drive Circuit, finishes the action of inflating and deflating cuff. Moreover, it supplies motor status signal to A/D converter for detection.

NIBP Signal Process Circuit

NIBP signals are differential signals. Differential Amplify circuit amplifies the differential signals and converts them into single ended signals and at the same time sends the signal of one way to A/D converter and the signal of the other way to the Blocking and AMP circuit.
Blocking and AMP circuit removes the DC components in the signals, amplifies the signals and then sends them into A/D converter.

A/D

Convert analog signals into digital signals and send them into CPU part for further processing.

Over Pressure Detect

Detect NIBP pressure signals. Once the pressure exceeds the protection limit, it sends the message to CPU System, which will accordingly control the Valve Drive Circuit to open the valve to deflate the cuff so as to reduce the pressure.

CPU System

Realize logic control over the whole circuit;
Process NIBP data;
Communicate with main board.

3.8 Recorder Module

3.8.1 General

This module is designed to drive line thermal printer.

3.8.2 Schematic Diagram

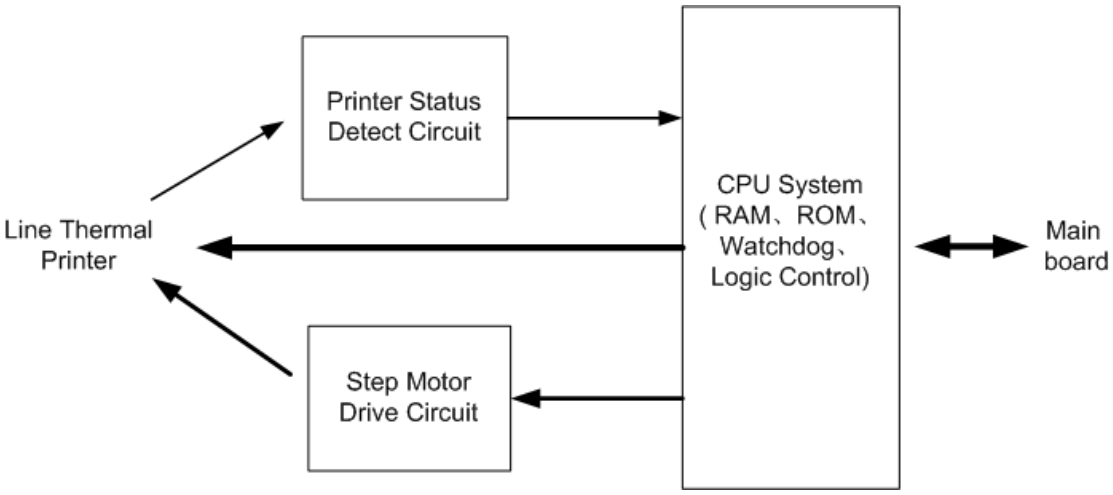


Figure 3-8 Recorder Module

3.8.3 Introduction to Principle

This module receives printing data from the main board. At the same time of converting the data into dot matrix data and sending them to the printer, it also drives the printer to start printing action.

Step Motor Drive Circuit

A step motor is used in the printer to feed paper. This circuit is designed to drive the step motor to act.

Printer Status Detect Circuit

Detect the status of the printer, including the position of paper platen, if there is paper, and temperature of thermal head and send the information to CPU System.

CPU System

Process printing data;
Control printer and step motor;
Collect printer status information and realize corresponding control;
Communicate with main board.

3.9 Keyboard

3.9.1 General

This module acts as the man-machine interface.

3.9.2 Schematic Diagram

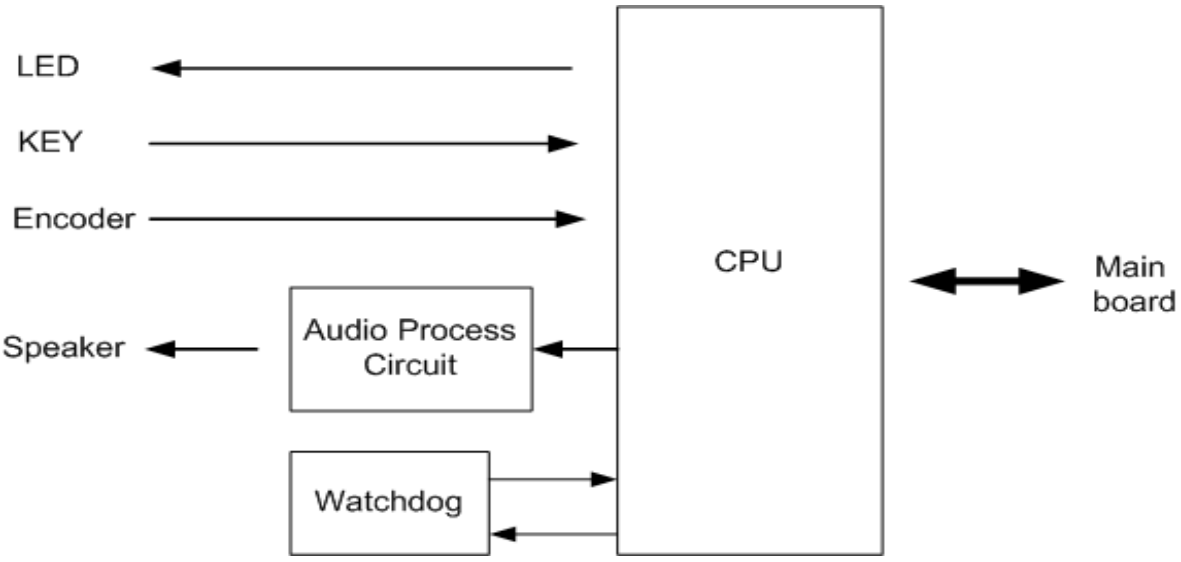


Figure 3-9 Keyboard

3.9.3 Introduction to Principle

This module detects key and encoder input signals, converts them into codes and sends to the main board. The main board sends command to the keyboard and the latter accordingly control indicator and audio process circuit to act so as to realize audio and visual alarm.

CPU

Detect key and encoder input signals;
Control LED status;
Control Audio Process Circuit;
Regularly zero Watchdog Timer;
Communicate with main board.

Audio Process Circuit

Generate audio signals to drive the speaker to give sound.

Watchdog

Upon power-up, supply Reset signal to CPU;

Provide functions of Waterdog Timer Output and voltage detection.

3.10 Power Board

3.10.1 General

This module provides DC supplies to other boards.

3.10.2 Schematic Diagram

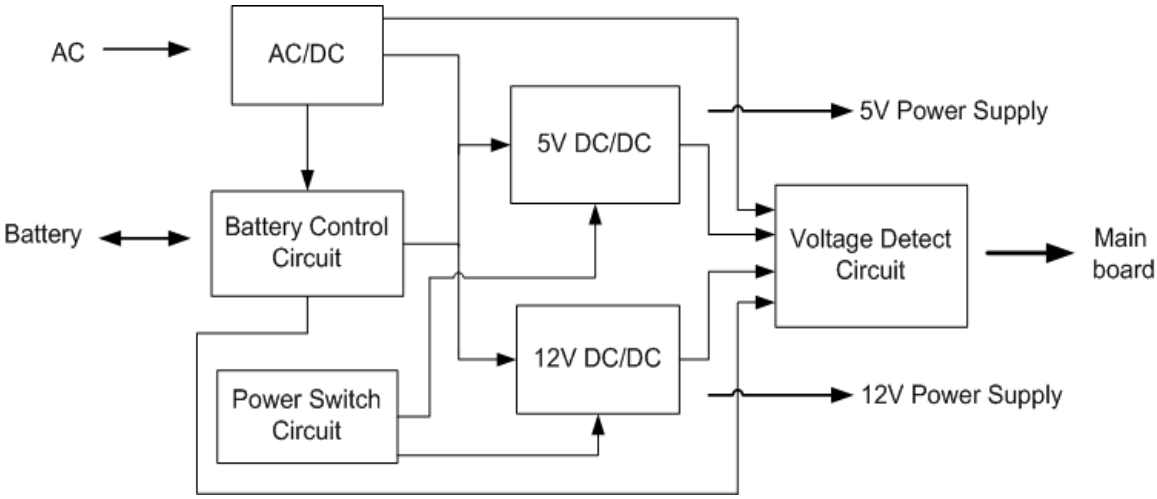


Figure 3-10 Power Board

3.10.3 Introduction to Principle

This module converts 220V AC mains or battery power into 5V and 12V DC supplies to power other boards. If AC mains and battery coexist, the former take the priority to power the system and charge the latter at the same time.

AC/DC

Convert high-voltage AC supply into low-voltage DC supplies to power subsequent circuits and charge the battery.

Battery Control Circuit

If AC mains and battery coexist, this circuit controls the output from AC/DC part to charge the battery. If AC mains is disconnected, this circuit controls the battery to power the subsequent circuits.

5V DC/DC

Convert the DC supply from the previous circuit into stable 5V DC supply to power other boards.

12V DC/DC

Convert the DC supply from the previous circuit into stable 12V DC supply to power other boards.

Power Switch Circuit

Control the working status of 5V DC/DC and 12V DC/DC in order to control ON/OFF action of the patient monitor.

3.11 CO2 Module

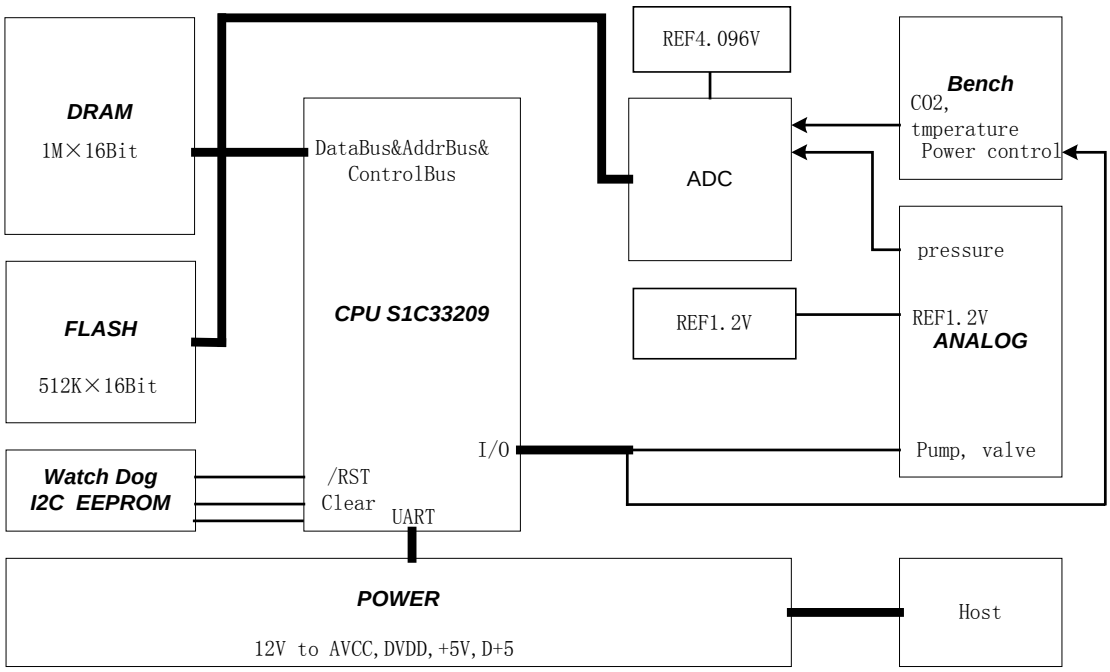
Mindray can provide the following CO2 modules: Mindray Side-stream CO2 module,OEM product from Welch Allyn OEM Technologies.

Mindray CO2 Module

General

This module is designed to measure the parameters of CO2.

Schematic Diagram



Principle Introduction:

Principle of Sidestream CO2 measurement is primarily based on the analytic technique of non-dispersive infrared spectrum (NDIR), making use of the fact that CO2

molecule can absorb 4.26um infrared ray.

Main control board

The main control board mainly is used to fulfill the following functions: data acquisition and processing, state monitor (including working voltage, ambient pressure and internal pressure of air way, sampling line and air way state), detection and control of sample gas flow and communication with the host through serial ports. The structure of main control board is demonstrated in Figure 3. It can be divided into the following functional units:

Power circuit

Microprocessor and its external memory storage

A/D transformation circuit

Pressure detection circuit

Flow detection and control circuit

Valve control circuit

Steady-speed control circuit of chopping electrical motor

Reset, watchdog and EEPROM circuit

Analog signal clamping protection circuit

Sensor board

Working principle of sensor board is as follows: the infrared ray sent by infrared light source is converted into pulsed light signal by chopper, and as carried signal, it is modulated by the variation of CO2 concentration when passing the gas chamber. The sensor converts the modulated optical signal into electrical signal. After signal amplification and processing circuit, the voltage signal reflecting the variation of CO2 concentration in gas chamber is obtained. It can be divided into the following functional units:

Power circuit

CO_2 measurement chamber

Signal processing circuit

Temperature detection circuit

Air way system

Air way system is used to extract certain amount of expiratory gas from the patient for measurement. It consists of sample line, water trap, triple-valve, measurement chamber,orifice restrictor,, air way buffer, extraction pump and discharge pipe.

OEM product from Welch Allyn OEM Technologies.

The measurement of CO_2 is based on the infrared absorption characteristic of CO_2 molecule. For different ways of connecting the infrared sensor, PM-9000 monitor offers either a main-stream or a side-stream module.

Side-stream:

The Side-stream module is mainly made up of circuit board, internal side-stream infrared sensor, air pump and control unit. The infrared sensors do not need a preheating phase.
When using side-stream module, the user should also use external connected watertrap and sample line.
In side-stream mode, based on the patient situation, the user may set up the pump rate as 100, 150 or 200ml/min.
When not performing CO_2 measurement, the work mode should be set to “STANDBY” to extend the life cycle of the module and reduce the power consumption.

Main-stream:

The Main-stream module is mainly made up of circuit board and external main-stream infrared sensor. The IR sensor requires a relatively long preheating phase
When not performing CO_2 measurement, the work mode should be set to “STANDBY” to extend the life cycle of the module and reduce the power consumption.

3.12 AG Module

AG Measurement method:
Non-dispersive infra-red, NDIR
AG Measurement circuit
The absorption peaks of Multigas：4.2um[CO2] , 3.9um[N2O] , 8--12um[Anesthetic Gas]

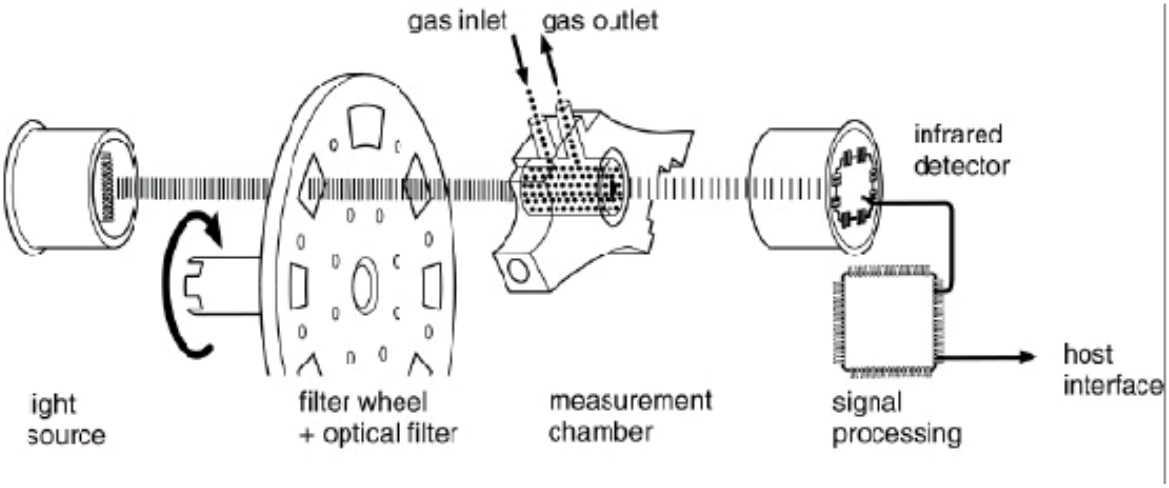


Figure 3-11 AG module

The light transmitted from the infrared source is filtered using a set of narrow optical band pass filters. The individual filters are mounted in a rapidly rotating filtered light then passes through the measurement chamber before reaching the infrared detector.

Oxygen measurement method : Paramagnetic method
Oxygen Measurement circuit

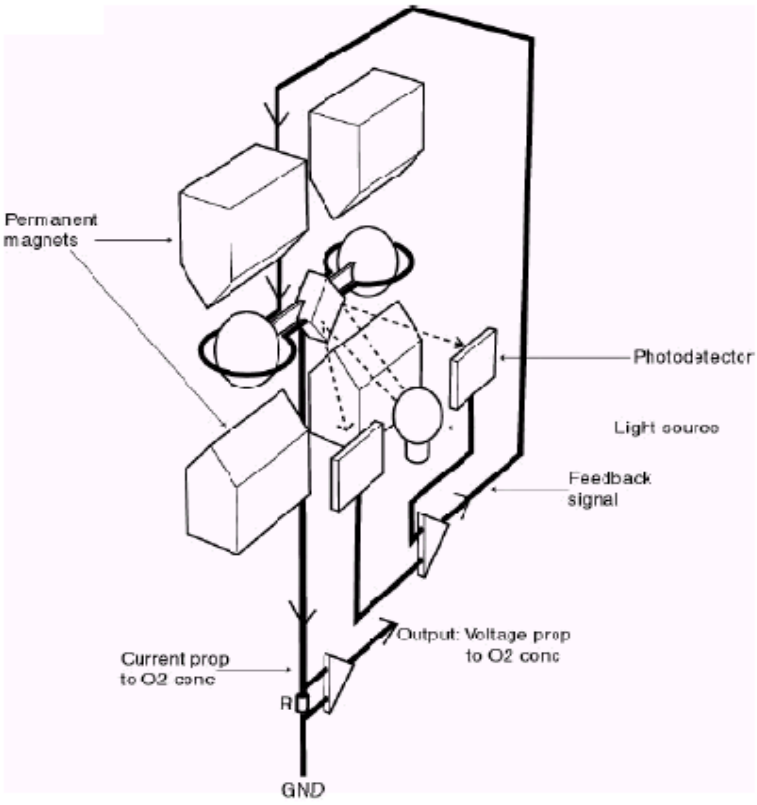


Figure 3-12 Oxygen Module

The transducer uses the paramagnetic susceptibility of oxygen, a physical property that distinguishes oxygen from most other common gases. Inside the sensor, there are two nitrogen-filled glass spheres mounted on a strong rare metal taut-band suspension. This assembly is suspended in a symmetrical non-uniform magnetic field. In the presence of paramagnetic oxygen, the glass spheres are pushed further away from strongest part of the magnetic field. The strength of the torque acting on the suspension is proportional to the oxygen concentration.

The measuring system is “null-balanced’. The ‘zero’ position of the suspension assembly, as measured in nitrogen, is sensed by attached to the suspension assembly. The output from the photo sensor is feedback to a coil wound around the suspension assembly.

This feedback achieves two objectives. First, when oxygen is introduced to the cell, the torque acting on the suspension assembly is balanced by a restoring torque from the feedback current in the coil. The feedback current is directly proportional to the volume magnetic susceptibility of the sample gas and hence, after calibration, to the partial pressure of oxygen in the sample. A voltage output is derived that is proportional to the current, which in turn means that the voltage is proportional to the O2 concentration.

3.13 MASIMO SPO2 Module

Masimo’s technology is composed of three components;

(1) new signal processing apparatus,

(2) a new method for invivo measurement,

(3) new sensor technology.

Conventional fixed filters, have been designed to pass certain frequencies while rejecting others.But they can not reject the noise which in pass band.

Adaptive filters can be used to reject predicted noise from the measurement by tuning the filter parameters to the noise's predicted frequency characteristics. These adaptive filters are designed to pass desired signals and reject undesired signals by relying on either predictable signals or predictable noise and rejecting the noise.

"Freezing" of the data- when noise is detected, the last measurement is repeated until a new clean signal is detected and a new measurement calculated.

"averaging" of the data- signals are averaged over a long period of time reducing the effect of only temporary erroneous measurements due to noise.

Sensitivity mode	Signal strength threshold	Sensor off handing
Low perfusion- default	0.50 to 0.02	Optimized for long term and continuous monitoring
Low perfusion- maximum	0.02	Optimized for supervised monitoring

In the default mode, the perfusion threshold has different limits as the perfusion calculation is data dependent. There is an intelligent algorithm which adjusts the low perfusion limits in accordance with the quality of the incoming plethymograph waveform.

There is no electrical isolation between the power and communications connector and the sensor connector.(J3) Connector J3 is the power and communications connector. The power and communications connector supplies power and provides a communications path to the circuit board.

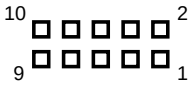
Pin Number	Label	Description
	Vin	input voltage supply
2	gnd	ground
3		reserved
4	gnd	ground
5	anout	analog out
6	gnd	ground
7	reset	reset
8	dav	data available
9	rx	serial receive
10	tx	serial transmit

Figure 3-13: Power and Communications Connector J3

Sensor Connector

J1 is the Sensor Connector. The Sensor Connector connects to a sensor through an Instrument Cable and a Patient Cable.

The Instrument Cable connects the MS-7 Board to a Patient Cable. The design of this cable will be unique for each application of the MS-7 Board. The requirements for the design of an Instrument Cable are described in document ADR-1022, Stork Instrument Cable Design Requirements.



Pin Number	Label	Description
1	anode	photodiode anode
2	cathode	photodiode cathode
3	agnd	analog ground
4	agnd	analog ground
5		reserved
6	agnd	analog ground
7	ircat	ir LED cathode
8	agnd	analog ground
9	redcat	red LED cathode
10		reserved

Figure 3-14: Sensor Connector J1

Principle of operation

Be based on three principles:

1. oxyhemoglobin and deoxyhemglobin differ in there absorption of red and infrared light(spectrophotometry).

2. The volume of arterial blood in tissue and the light absorbed by the blood changes during the pulse (plethymography).
3. Arterio-venous shunting is highly variable and that fluctuating absorbance by venous blood is a major component of noise during the pulse.

The MASIMO pulse oximeter as well as traditional pulse oximeter determines SPO2 by passing red and infrared light into capillary bed and measuring changes in light absorption during the pulsatile cycle. Red and infrared light-emitting diodes (LEDs) in oximeter sensors serve as the light sources, a photodiode serves as the photo detector.

Traditional pulse oximeter assumes that all pulsations in the light absorbance signal are caused by oscillations in the arterial blood volume. This assumes that the blood flow in the region of the sensor passes entirely through the capillary bed rather than through any arterio-venous shunts. The traditional pulse oximeter calculates the ratio of pulsatile absorbance (AC) to the mean absorbance (DC) at each of two wavelengths, 660nm and 940nm:

S(660)=AC(660)/DC(660)

S(940)=AC(940)/DC(940)

The oximeter then calculates the ratio of these two arterial pulse-added absorbance signals:

R=S(660)/S(940)

This value of R is used to find the saturation SPO2 in a look –up table built into the oximeter's software. The values in the look-up table are based upon human blood studies against a laboratory co-oximeter on healthy adult volunteers in induced hypoxia studies.

Masimo set assumes that arterio-venous shunting is highly variable and that fluctuating absorbance by venous blood is the major component of noise during the pulse. It decomposes s(660) and s(940) into an arterial signal plus a noise component and calculates the ratio of the arterial signals without the noise:

S(660)=s1+n1

S(940)=s2+n2

R=s1/s2

R is the ratio of two arterial pulse-added absorbance signals and its value is used to find the saturation spo2 in an empirically derived table into the software. The values in the empirical table are based upon human blood studies against a laboratory on healthy adult volunteers in induced hypoxia studies.

The above equation are combined and a noise reference (N') is determined:

N'=S(660)-S(940)*R

If there is no noise N'=0; then s(660)=s(940)*R which is the same relationship for traditional pulse oximeter.

Chapter 4 Product Specification

4.1 Classification

Anti-electroshock type	Class I equipment with internal power supply
Anti-electroshock degree	ECG (RESP), SpO_2, NIBP, IBP, TEMP, CO, CO_2 CF
	AG BF
EMC	Class A
Harmful liquid proof degree	Ordinary equipment (sealed equipment without liquid proof)
Disinfection/sterilizing method	Refer to Operation Manual for details.
Working system	Continuous running equipment

4.2 Specifications

4.2.1 Size and Weight

Size	Monitor	318 x 144 x 264 mm
Weight	Monitor	5.5 kg

4.2.2 Environment

Temperature	
Working	0～40°C
Welch Allyn Sidestream CO_2	+5ºC～+35ºC
Welch Allyn Mainstream CO_2	+10ºC～+40ºC
Sidestream CO_2	+5ºC～+35ºC
Artema AION Anesthesia Gases	+10ºC～+40ºC
Storage	-20～60°C
Humidiity	
Working	15%～95 %(noncomdensing)
Storage	10%～95 %(noncomdensing)
Altitude	
Working	-500～4,600m(-1,600～15,000ft)
Sidestream CO_2	-350～4,600 m (-1,150～15,000ft)
Storage	-500～13,100m(-1,600～43,000ft)
Power Supply	
	100～240 (V) AC, 50/60 (Hz)
	Pmax=110VA
	FUSE T 1.6

4.2.3 Display

Device	12.1 (in.) Color TFT, 800 x 600 Resolution, 3 LED
Messages	8 Waveforms Maximum
	1 Alarm LED (Yellow/Red)
	1 Power LED (Green)
	1 Charge LED (Green)
	3 Sound Mode corresponding Alarm Mode

4.2.4 Signal Interface

External display	Standard VGA
AUX Output	BNC
ECG Output	
Sensitivity	1 V/mv ± 5%(reference 10Hz)
Impedance	50 (ohm)
Signal Delay	ECG：25ms
IBP Output	
Sensitivity	1 V/100mmhg± 5% (reference 1Hz)
Impedance	50 (ohm)
Signal Delay	IBP：55ms

NURSE CALL Output

NURSE CALL function is realized through external NURSE CALL cable.

Output signal type	NORMAL OPEN/NORMAL CLOSE is software controlled
Max. voltage	36V DC OR 25V AC
Max. load current	1A
On resistance	<1Ω
Isolation voltage:	1500VAC

4.2.5 Battery

Rechargeable Lead-Acid	2.3Ah 12V
Operating time under the normal condition	100 minutes (2 batteries)
Operating time after the first alarm of low battery	>5 minutes

Maximum charging time of single battery is 4 hours. Maximum charging time of two batteries is 8 hours.

4.2.6 Recorder (Optional)

Record Width	48 (mm)
Paper Speed	25/50(mm/s)
Trace	2
Recording types	
	Continuous real-time recording
	8 second real-time recording

Auto 8 second recording
Parameter alarm recording
Waveform freeze recording
Trend graph/table recording
ARR events review recording
Alarm event review recording
NIBP review recording
CO_2 Measurement review recording
AG Measurement review recording
CO Measurement curve recording
Hemodynamic Calculation result recording
Drug Calculation and titration table recording
Monitor information recording
oxyCRG review recording

4.2.7 Recall

Trend Recall	
Short	1 hour, 1 second or 5 second Resolution
Long	72 (hrs), 1 min, 5min or 10 min Resolution
Alarm Event Recall	60 alarm events of all parameters and 8,16 or 32 seconds of corresponding waveform.
NIBP Measurement Recall	400 NIBP measurement data.

4.2.8 ECG

Lead Mode	5 Leads (R, L, F, N, C or RA, LA, LL, RL, V)
Lead selection	I, II, III, avR, avL, avF, V
Waveform	2 ch
Lead mode	3 Leads (R, L, F or RA, LA, LL)
Lead selection	I, II, III
Waveform	1 ch
Gain	×2.5mm/mV,×5.0mm/mV,×10mm/mV,×20mm/mV, auto
HR and Alarm	
Range	
Adult	15～300 (bpm)
Neo/Ped	15～350 (bpm)
Accuracy	±1% or ±1bpm, use the greater
Resolution	1 (bpm)
Sensitivity	≥ 200 (uV) P-P
Differential Input Impedance	> 5 (Mohm)
CMRR	
Monitor	≥ 105 dB
Surgery	≥ 105 dB
Diagnostic	≥ 90 dB

Electrode offset potential	±300mV
Patient Leakage Current	< 10 (uA)
Recovery after Defi	< 3 (s).
ECG Signal Range	± 8 (mV) p-p
Bandwidth	
Surgery	1～20 Hz
Monitor	0.5～40 Hz
Diagnostic	0.05～100 Hz
Calibration Signal	1 (mV) p-p, ±5% Accuracy
ST Segment Monitoring Range	
Measure and Alarm	-2.0～+2.0 (mV)
Accuracy	-0.8mV～+0.8mV：±0.02mV or ±10%, use the greater
ARR Detecting	
Type	ASYSTOLE, VFIB/VTAC, COUPLET, BIGEMINY, TRIGEMINY, R ON T, VT>2, PVC, TACHY, BRADY, MISSED BEATS, PNP, PNC
Alarm	Available
Review	Available

4.2.9 RESPARATION

Method	Impedance between RA-LL
Differential input Impedance:	>2.5 MOhm
Measuring Impedance Range:	0.3～5.0Ω
Base line Impedance Range:	200Ω～2500Ω
Bandwidth	0.2～2Hz (-3 dB)
Resp.Rate	
Measuring and Alarm Range	
Adult	0～120 (BrPM)
Neo/Ped	0～150 (BrPM)
Resolution	1 (BrPM)
Accuracy	7～150 BrPM：±2 BrPM 或±2%,use the greater
	0～6 BrPM：unspecified
Apean Alarm	10～40 (s)

4.2.10 NIBP

Method	Oscillometric
Mode	Manual, Auto, STAT
Measuring Interval in AUTO Mode	1, 2, 3, 4, 5, 10, 15, 30, 60, 90, 120, 180, 240, 480 min

Measuring Period in STAT Mode	5 (Min)
Alarm	
Type	SYS, DIA, MEAN
Measuring and alarm range	
Adult Mode	
SYS	40～270 mmHg
DIA	10～210 mmHg
MEAN	20～230 mmHg
Pediatric Mode	
SYS	40～200 mmHg
DIA	10～150 mmHg
MEAN	20～165 mmHg
Neonatal Mode	
SYS	40～135 mmHg
DIA	10～100 mmHg
MEAN	20～110 mmHg
Resolution	
Pressure	1mmHg
Cuff pressure accuracy	± 3mmHg
Accuracy	
Pressure	
Maximum Mean error	±5mmHg
Maximum Standard deviation	8mmHg
Overpressure Protection	
Adult Mode	297±3 mmHg
Pediatric Mode	240±3 mmHg
Neonatal Mode	147±3 mmHg

4.2.11 SpO2

Measuring Range	0～100 %
Alarm Range	0～100 %
Resolution	1 %
Accuracy	70%～100%: ±2 %
	0%～69%: unspecified
Actualization interval	about 1(Sec.)
Alarm Delay	10 (Sec.)
Pulse Rate	
Measuring and Alarm Range	20～254bpm
Resolution	1bpm

Accuracy	±3bpm

MASIMO Specification:

Range

Saturation (%SpO2)	1%～100%
Pulse Rate (bmp)	25～240

Accuracy

Saturation(%SpO2) － During No Motion Conditions	
Adults/pediatric	70%～100%: ±2%
	0%～69%: unspecified
Neonates	70%～100%: ±3%
	0%～69%: unspecified
Saturation(%SpO2) － During Motion Conditions	
Adults/ pediatric/ Neonates	70%～100％: ±3%
	0%～69%: unspecified
Pulse(bpm) － During No Motion Condition	
	25～240 ± 3BPM
Pulse(bpm) － During Motion Condition	
	25～240 ± 5BPM

Resolution

Saturation(%SpO2)	1%
Pulse Rate(bpm)	1

4.2.12 TEMPERATURE

Channel	2
Measuring and Alarm Range	0～50 °C
Resolution	0.1°C
Accuracy	±0.1°C (0～50 °C exclusive of probe errors)
Actualization interval	about 1(Sec.)
Average Time Constant	< 10 (Sec.)

4.2.13 IBP

Channel	2
Label	ART, PA, CVP, RAP, LAP, ICP, P1, P2

Measuring and alarm range

ART	0～300 mmHg
PA	-6～120 mmHg
CVP/RAP/LAP/ICP	-10～40 mmHg
P1/P2	-50～300 mmHg

Press Sensor

Sensitivity	5 (uV/V/mmHg)
Impedance	300～3000 (Ohm)

Resolution	1 mmHg
Accuracy	±2% or ±1mmHg, use the greater
Actualization interval	about 1(Sec.)

4.2.14 CO

Method	Thermodilution Technique
Measuring range	
CO	0.1～20 (L/min)
TB	23～43 (°C)
TI	0～27 (°C)
Resolution	
CO	0.1 (L/min)
TB,TI	0.1 (°C)
Accuracy	
CO	±5% or ± 0.1L/min
TB	±0.1 (°C)
TI	±0.1 (°C)
Calculation	CO, Hemodynamic Calculation
Alarm Range	23～43 (°C)

4.2.15 CO2

Method	Infra-red Absorbation Technique
Measuring mode	Sidestream
	(Welch Allyn Sidestream or Mindray Side-stream or Mainstream optional)
Side-stream mode sampling gas flow rate	
	100, 150, 200 ml/Min（Welch Allyn Side-stream--Optional）
	100，150ml/Min (Mindray Side-stream--Optional)
Measuring range	
CO_2	0～99 mmHg
INS CO_2	0～99 mmHg
AwRR	0～120 BrPM (Welch Allyn: 0～150 BrPM)
Resolution	
CO_2	1 mmHg
INS CO_2	1mmHg
AwRR	1 BrPM
Accuracy	
CO_2	±2 mmHg, 0～40 mmHg
	±5% of reading, 41～76 mmHg
	±10% of reading, 77～99 mmHg
AwRR	±2 BrPM
Actualization interval	about 1(Sec.)
Start-up Time	
	< 30 seconds typical in sidestream mode

	< 80 seconds in mainstream mode from 25°C ambient, 5W supplied to sensor heater (Mainstream sensor temperature controlled to 42°C)
Mainstream Response Time	<100 msec (10% to 90 %)
Sidestream Rise Time	<240 msec (10% to 90 %)
Sidestream Delay Time	1.12seconds maximum with 7-feet length, 0.055-inch ID. Sampling line at 150 ml/min
Mindray CO2 Delay Time	2 seconds maximum with 7-feet length, 0.055-inch ID. Sampling line at 150 ml/min
Alarm range	
CO_2	0～99 mmHg
Ins CO_2	0～99 mmHg
AwRR	0～120 BrPM (Welch Allyn: 0～150 BrPM)
Suffocation Alarm Delay	
AwRR	10～40 Sec

4.2.16 AG

Method	Infrared Absorption Technique
Measuring mode	Side-stream
Warm-up time	30 Sec Iso accuracy mode 10 Min Full accuracy mode
Side-stream mode sampling gas flow rate	
Adult:	100, 150, 200 ml/min (optional)
Neonate:	70, 90, 120 ml/min (optional)
Gas Sort	CO_2, N_2O, O_2 (Optional), Des, Iso, Enf, Sev, Hal
Measuring range	
CO_2	0～10%
N_2O	0～100%
Des	0～18%
Sev	0～8%
Enf, Iso, Hal	0～5%
O_2	0～100%(Optional)
awRR	2～100 BrPM
Resolution	
CO_2	1 mmHg
awRR	1 BrPM

Accuracy

	Accuracy	range
CO_2	±0.1%	0～1%
	±0.2%	1～5%
	±0.3%	5～7%
	±0.5%	7～10%
	Unspecified	> 10%
N_2O	±2%	0～20%

	±3%	20～100%
Des	±0.15%	0～1%
	±0.2%	1～5%
	±0.4%	5～10%
	±0.6%	10～15%
	±1%	15～18%
	Unspecified	>18%
Sev	±0.15%	0～1%
	±0.2%	1～5%
	±0.4%	5～8%
	Unspecified	> 8%
Enf, Iso, Hal	±0.15%	0～1%
	±0.2%	1～5%
	Unspecified	>5%
O_2 (Option)	±1%	0～25%
	±2%	25～80%
	±3%	80～100%
awRR	±1 BrPM	
Alarm range		
CO_2	0～10% (0～76 mmHg)	
awRR	2～100 BrPM	
Suffocation Alarm Delay		
awRR	20～40 Sec.	
Updating frequency	once per second	
Calibrate	once per year	
AG calibrate stability	after being used for consecutive 12 months, the deviation from precision is < 1%	
Rising time	600ms (10%～90 %),using DRYLINE watertrap and DRYLINE sampling line(2.5m).	
Delay time	<4second	

Chapter 5 Tests

⚠Warning⚠ All the below tests must be performed at least once per one year. After the monitor was opened for repairing,all the below tests must be performed before use it.Meantimes, the users must obey the local laws to perform the below tests.

5.1 System checks

For the conventional testing contents of PM-9000 patient monitor, please refer to its Operation Manual. The information in this chapter is only a brief introduction. The following sections are used to point out important tests and the information not clearly specified in the Operation Manual.

5.1.1 Device appearance and installation checks

1）The shell of the device is clean and has no scratches. The installation is stable. When shaking the device, these are no inside leftovers.
2）Buttons are smooth and free for operation.
3）Labels are complete and sufficient and correct in delivering information.
4）Standard configuration is complete, the sockets are installed safely.
5）Perform vibration test on the overall device before performing following operating tests.

5.2 Safety tests

Testing device: BIO-TEK®601PRO safety analyzer
Applied standard: IEC60601-1

Inspection items and methods

5.2.1 Protective Earth Resistance Test

5.2.1.1 Connection

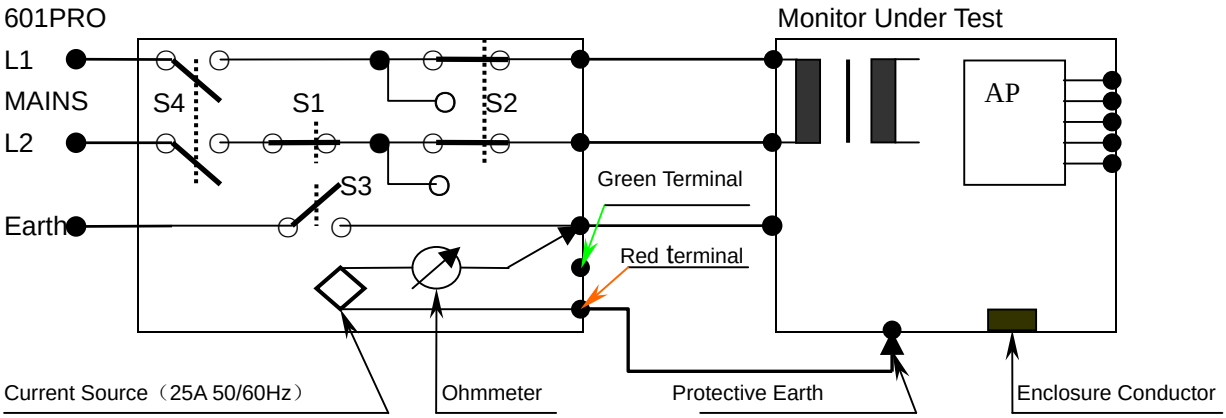
Plug the supply connector of the Monitor Under Test into the 601PRO front panel outlet; Performing the test as instructed in the Operator's Manual of 601PRO. (Set testing current to 25A).
Test of item a: use the Red Testing Lead (accessory of 601PRO) to connect the Red Terminal of 601PRO and Protective Earth Terminal or an accessible metal part of the Monitor Under Test;
Test of item b: use the Red Testing Lead to connect the Red Terminal and the Protective Earth

Terminal of the Monitor Under Test; use the Black Testing Lead (accessory of 601PRO) to connect the Green Terminal and any accessible conductor. Test principle is as shown in figure 5-1.

Testing results must comply with:

a. The resistance between the Earth Terminal of the power supply cord of the Monitor Under Test and the Protective Earth or any accessible conductor of the enclosure must be less than 0.2Ω;

b. The resistance between the Protective Earth of the Monitor Under Test and any accessible conductor of the enclosure must be less than 0.1Ω.



Note: switches S1 and S2 are not used; S3 and S4 are opened.

Figure 5-1 Protective Earth Resistance Test

5.2.2 Earth Leakage Current Test

5.2.2.1 Connection:

Plug the supply connector of the Monitor Under Test into the 601PRO front panel outlet; turn on the power; safely connect the AP of the Monitor Under Test to the AP Terminal of 601PRO. Test as instructed in the Operator's Manual of 601PRO. Test principle is as shown in figure 5-2.

5.2.2.2 Normal polarity or Reversed polarity:

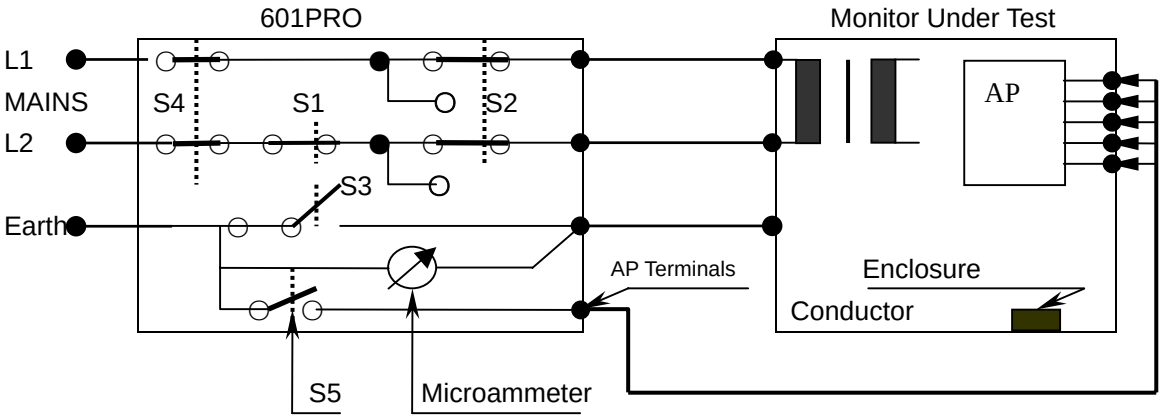
a: Earth open

b: Earth open and null line L2 open

Test results must comply with:

a: Earth open, the leakage current is less than 500μA;

b: Earth open and null line L2 open, leakage current is less than 1000μA.



Note: Switches S1, S2 and S5 are variable, S3 is opened, S4 is closed.

Figure 5-2 Earth Leakage Current Test

5.2.3 Enclosure Leakage Current Test

5.2.3.1 Connection:

Plug the supply connector of the Monitor Under Test into the 601PRO front panel outlet; turn on the power; use the Red Lead to connect the Red Terminal of 601PRO and any accessible conductor of the enclosure of the Monitor Under Test; safely connect the AP of the Monitor Under Test and the AP Terminal of 601PRO. Test as instructed in the operator's manual of 601PRO. Test principle is as shown in figure 5-3.

5.2.3.2 Normal polarity or Reversed polarity:

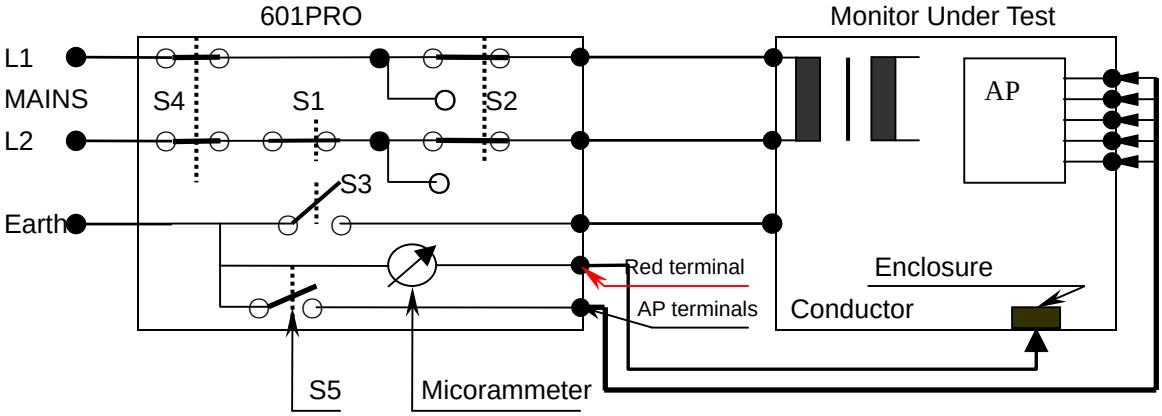
a: Normal condition

b: Single fault condition (Earth open or null line L2 open)

Test results must comply with:

a: In normal condition, the leakage current is less than 100μA;

b: In single fault condition (Earth open or null line L2 open),the leakage current is less than 500 μA.



Note: Switches S1, S2, S3 and S5 are variable, S4 is closed.

Figure 5-3 Enclosure Leakage Current Test

5.2.4 Patient Leakage Current Test

5.2.4.1 Connection:

Plug the supply connector of the Monitor Under Test into the 601PRO front panel outlet; turn on the power; safely connect the AP of the Monitor Under Test to the AP Terminal of 601PRO; test as instructed in the Operator's Manual of 601PRO. Test principle is as shown in figure 5-4.

5.2.4.2 Normal polarity or reversed polarity:

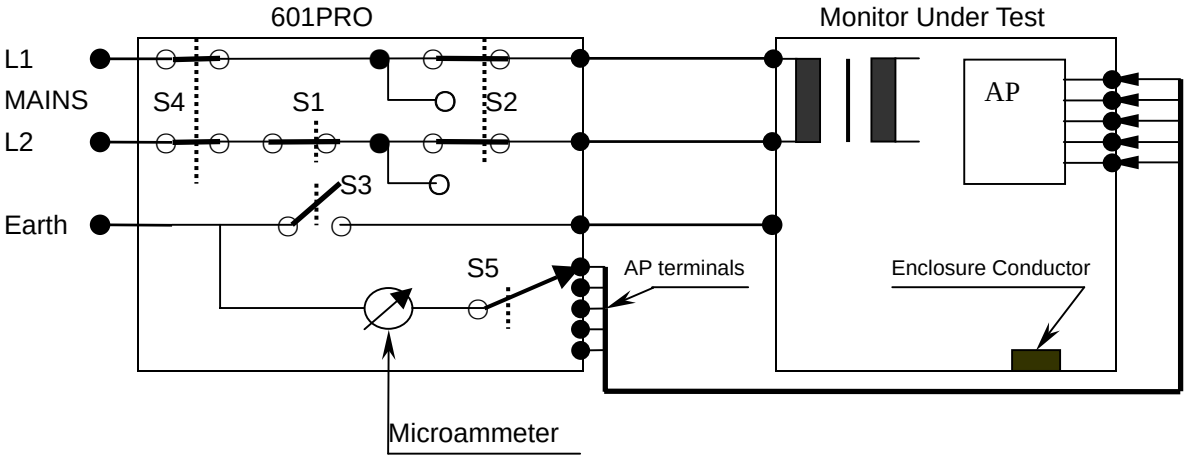
a: Normal condition

b: Single fault condition (Earth open or null line L2 open)

Test results must comply with:

a: In normal condition, the leakage current or DC leakage current is less than 10μA;

b: In single fault condition (Earth open or null line L2 open),the leakage current or DC leakage current is less than 50μA.



Note: Switches S1, S2, S3 and S5 are variable, S4 is closed.

Figure 5-4 Patient Leakage Current Test

5.3 Parameter function testing

5.3.1 Testing ECG and RESP

5.3.1.1 Testing tool

Human physiological signals simulator (BIO-TEK MEDSIM 300B)

5.3.1.2 Testing procedures

① Use measuring cable to connect the simulator into the ECG socket of PM-9000
② Confirm if the number of ECG waveforms displayed on the screen is consistent with that indicated in the ECG MENU and Factory MENU.
③ In default configuration, select lead II for ECG1 and lead I for ECG2 (if there is ECG2)
④ Check if ECG waveforms and RESP waveforms are normally displayed.
⑤ Set up the parameters of the simulator as following;
HR=30（gain×2）
RR=15
⑥ Check if the displayed ECG and RESP waveforms, HR and RR values are correct.
⑦ Change the simulator configuration
HR=240
RR=120
⑧ Check if the displayed ECG and RESP waveforms, HR and RR values are consistent with the parameters set up on the simulator.
⑨ Make the ECG lead fall off, in this condition, the PM-9000 should immediately give alarm.

5.3.2 Testing NIBP

5.3.2.1 Testing tool

NIBP simulator (Cufflink)

5.3.2.2 Testing procedures

Use the NIBP simulator with checking function. Check the blood pressure pump and determine its accuracy according to the checking method given in the Operation Manual. If it passes the checking, continue to perform following tests.

① Select Adult mode for both simulator and PM-9000
② Select a group of blood pressure values within the measurement range on the NIBP simulator, such as:
NS=90
NM=70
ND=60
③ Check if the actual measured values of PM-9000 are consistent to those set up on the simulator.
④ Change the setup values on the simulator, and test again.
⑤ Check if the actual measured values are consistent with setup one.

5.3.3 Testing SpO2

5.3.3.1 Testing tool

SpO2 simulator (BIO-TEK)

5.3.3.2 Testing procedures

① Connect SpO2 simulator with the SpO2 probe of PM-9000
② Set up the parameters of SpO2 simulator as following:
SpO2=98
PR=70
③ Check if the displayed SpO2 and PR values on PM-9000 are consistent with those on the simulator.
（Note: To observe the PR value, select PLETH as the HR source in the ECG menu.）
④ Change the setup values of SpO2 and PR on the simulator.
⑤ Check the displayed values on PM-9000 are consistent with the setup values.
⑥ Make SpO2 sensor fall off, in this condition, PM-9000 should immediately give alarm.

5.3.4 Testing TEMP

① YSI probe

Select YSI TEMP probe in the factory menu; select YSI TEMP probe in the fixture of TEMP test; simulate resistance of 1.355K. The display for TEMP shall be 37±0.1℃;
② CY-F1 probe

Select CY-F1 TEMP probe in the factory menu, select CF-Y1 TEMP probe in the fixture of TEMP test; simulate resistance of 6.018K. The display for TEMP shall be 37±0.1℃.

5.3.5 Testing IBP

5.3.5.1 Testing tool

Human physiological signals simulator (medsim 300B)

5.3.5.2 Testing procedures

① Testing IBP1:

Set up the BP sensitivity of the simulator to 5uv/v/mmHg, and BP to 0mmHg. Set up the name of IBP1 to ART. Access the PRESSURE ZERO option of IBP SETUP MENU of PM-9000, zero Channel 1 to perform zero calibration for IBP. After the zero calibration is successful, exit the menu to enter the main screen. Set up the BP of the simulator to 200mmHg. Access the CALIBRATION menu of PM-9000 to perform calibration operation. After the calibration is successful, exit the menu.

Set up the BP of the simulator respectively to 40mmHg, 100mmHg, and 200mmHg. In the mean time, the screen should respectively display 40±1mmHg, 100±2mmHg, and 200±4mmHg.

Set up the output of the simulator as the ART wave. As the result, the screen should display the corresponding waveform correctly.

Plug off the IBP sensor. The screen should display “IBP: SENSOR 1 OFF!” “IBP: SENSOR 2 OFF!”.

Plug OHMEDA cable into IBP1 channel, the display of “IBP: SENSOR 1 OFF!”. Should disappear from the screen.

② Testing IBP2:

Plug IBP cable into IBP2 channel and repeat procedures .

5.3.6 Testing CO:

5.3.6.1 Testing tool

Human physiological signals simulator (medsim 300B)

5.3.6.2 Testing procedures

Testing TI and TB: Connect TB and TI testing kit and it outputs respectively TB36℃,37℃,38℃. In this case, TB should respectively display 36.0±0.1℃, 37.0±0.1℃, 38.0±0.1℃. Set the injection switch to “ON”, the outputs are TI 0℃, 2℃ and the screen should display 0±0.1℃, 2.0±0.1℃.

Testing CO measurement: set the CO.CONST and TI to their default values, i.e., 0.542 and 0 ℃. Set the injection switch to “OFF” and press the “START CO” option. After about 2 seconds, let the simulator outputs respectively 0℃, 2.5L/M and 0℃, 5L/M, therefore CO value should be displayed as 2.5±0.25L/M and 5±0.5L/M.

5.3.7 Testing CO2

5.3.7.1 Testing tool

10% CO_2 calibration gas, bal. N2

T-piece with tubing

A flow meter for minimum 200mL/min

⚠ **Note** ⚠ Prior to any test of the CO2 function ensure that module is in “MEASURE” mode for at least 10 minutes.

5.3.7.2 Testing procedures Mainstream

- Mainstream CO_2: Set Compensation value for calculation to “General”.
  1. Plug the mainstream sensor into the CO_2 socket on the monitor, and connect the airway adapter with the calibration CO_2 gas.
  2. Open/close the valve of the CO_2 calibration bottle every 3s. The displayed CO_2 value should be the calibration value 76±5%mmHg (10%±1). If you let the switch of value open all along, there should be an “Apean” alarm prompt.
  3. Plug off the sensor. The PM-9000 should display “CO2 SENSOR OFF”.
  4. Plug in the sensor. The PM-9000 should display “CO2 SENSOR IS HEATING”.

5.3.7.3 Testing procedures Sidestream

- Sidestream CO_2: Set Compensation value for calculation to “General”.
  1. Plug the watertrap into the watertrap socket on the monitor and connect the sampling hose with the CO_2 steel bottle.
  2. Open/close the value of CO_2 calibration bottle every 3s. The displayed CO_2 value should be the calibration value 76±5%mmHg (10%±1). Whenever you open the switch of the valve, there should be an “Apnea” alarm prompt.
  3. Remove the watertrap. The monitor displays “CO2 WATERTRAP OFF”, which will disappear after reinserting the watertrap.

5.3.8 Testing AG

5.3.8.1 Testing tools

· Calibration gases.
· T-piece with tubing.
· A flow meter for 200 ml/min, e.g. a rotameter.

⚠ **Note** ⚠ The calibration gas must comply with the following specifications:

· Agent concentration in gas mixture must be >1.5%.
· CO2 concentration in gas mixture must be >1.5%.
· N2O concentration in gas mixture must be >40%.
· O2 concentration in gas mixture must be >40%.

⚠ **Note** ⚠ The gas measurements may be calibrated individually using single component gas mixtures such as 5% CO2 balance. N2.

⚠ **Note** ⚠After a gas calibration has been performed, check the calibration by connecting another gas cylinder including at least one of the gases measured by the AG module.
Check that the AG module measures the correct concentration.
we recommend using the following gas mixture when performing this check:

3% Des, 5% CO2, 50% N2O, 42% O2.

5.3.8.2 Maintenance procedures

Monthly maintenance procedure

- Replace the water trap every month or more often if the monitor indicates this.

Annual maintenance procedure

- Replace the Nafion tubing (replace the DRYLINE™ Receptacle mounted in the cabinet including the Nafion tubing).
- Perform a leak test
- Perform a “VERIFY ACCURACY” check.

5.3.8.3 General maintenance setup

The following setup is used in most of the maintenance procedures described in the following sections.

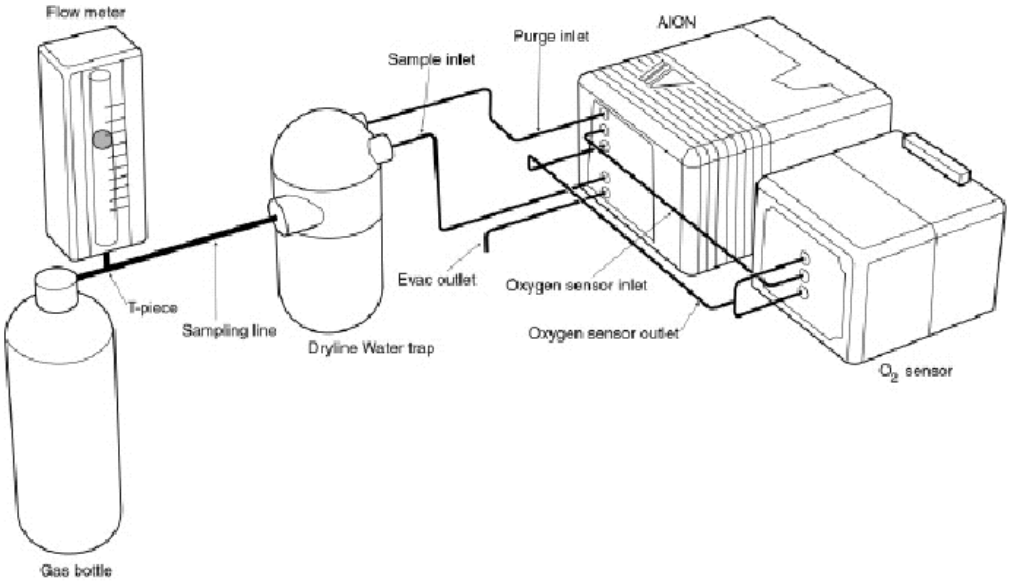


Figure 5-5 Maintenance set-up.

⚠ **Note** ⚠ The connections between the Dryline Watertrap and the items shown to the right are internally in the PM-9000. The user must connect the Dryline Watertrap, flowmeter, sampling line and gas bottle only

5.3.8.4 Leak test

This procedure is part of the annual maintenance procedure.
Set up the PM-9000 according to the following figure below with the sample flow set to 200 ml/min, and allow it to enter normal operation mode.
Occlude the sampling tubing connected to the water trap while the PM-9000 is operating.
Check that there is no air coming out of the Evac outlet, located on the side of the monitor, by "dipping" the evacuation tubing into a beaker of water. There must not be more than 2 bubbles/30 seconds.

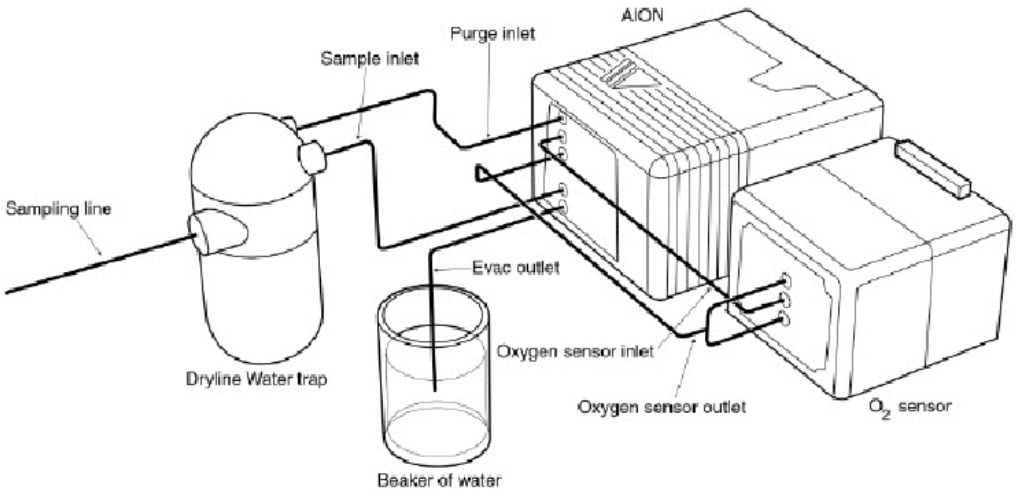


Figure 5-6 Leak test set-up

⚠ **Note** ⚠ The figure shows the internal AG module in the PM-9000. The user should only connect the Dryline watertrap, sampling line and the evacuation outlet line.

⚠ **Note** ⚠ The tubing being dipped into the water must be the type that we recommends for the outlet and must be at least 1.5 m long. Before switching the PM-9000 off, the tubing must be disconnected so that no water is sucked into the unit.

⚠ **Note** ⚠ The automatic reference measurements carried out by the AG module may momentarily interfere with the leak test procedure.

If the leak test requirement is not fulfilled, the pneumatic system should be carefully checked for leaks and damaged tubing. The leak test should then be repeated.

5.4 NIBP CALIBRATE

Calibrate the cuff pressure reading with a calibrated reference manometer. Pick the CALIBRATE item to start the calibration and the item will change into STOP CAL, which if picked, the system will stop calibration.

Procedure of the Pressure Transducer Calibration:

Replace the cuff of the device with a rigid metal vessel with a capacity of 500 ml ± 5%. Connect a calibrated reference manometer with an error less than 0.8 mmHg and a ball pump by means of a T-piece connector and hoses to the pneumatic system. Set the monitor in **CALIBRATE** mode. Inflate the pneumatic system to 0, 50 and 200 mmHg by ball pump separately. The difference between the indicated pressure of the reference manometer and the indicated pressure of the monitor will not exceed 3 mmHg. Otherwise, please adjust the R2 adjustable resistance on the NIBP board to modify the value.

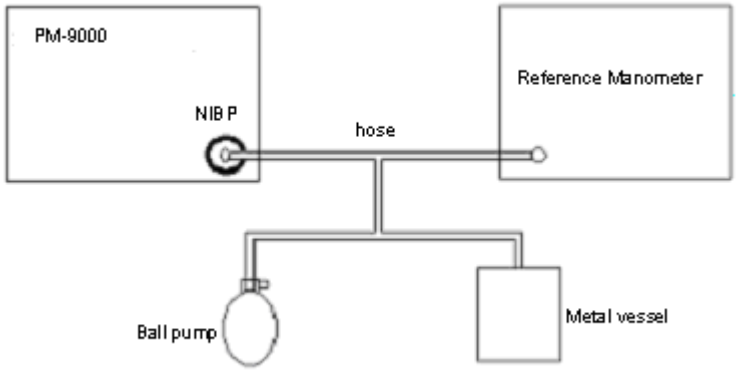


Figure 5-7 Diagram of NIBP calibration

5.5 IBP CALIBRATE

IBP Transducer Zero

- Press the ZERO button on the IBP module to call up IBP PRESSURE ZERO menu as shown below:

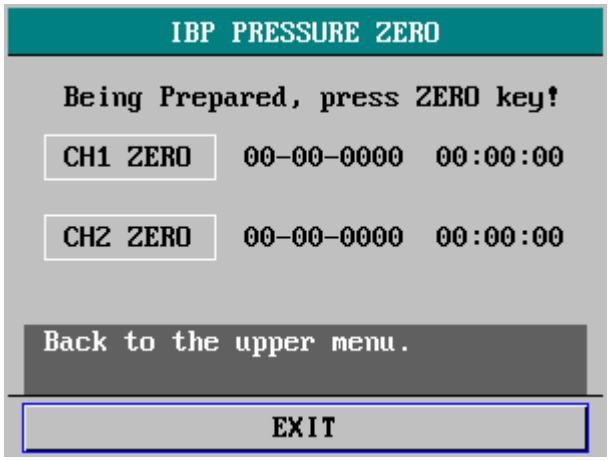


Figure 5-8 IBP PRESSURE ZERO

Zero Calibration of Transducer

Select CH1, the system will zero IBP1. Select CH2, the system will zero IBP2.

Cautions:(Use the PM-6000 IBP module as a example)

- Turn off patient stopcock before you start the zero procedure.
- The transducer must be vented to atmospheric pressure before the zero procedure.
- The transducer should be placed at the same height level with the heart, approximately mid-axially line.
- Zero procedure should be performed before starting the monitoring and at least once a day after each disconnect-and-connect of the cable.

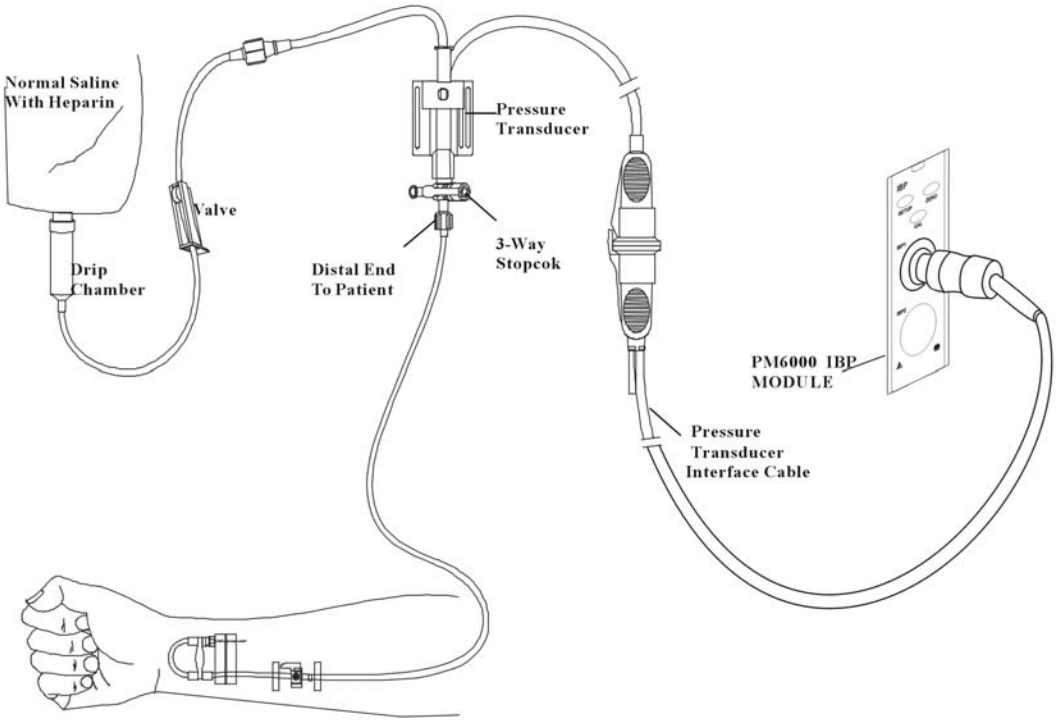


Figure 5-9 IBP Zero

IBP Calibration

- Press CAL button on the IBP module to call up the IBP PRESSURE CALIBRATE menu as shown below:

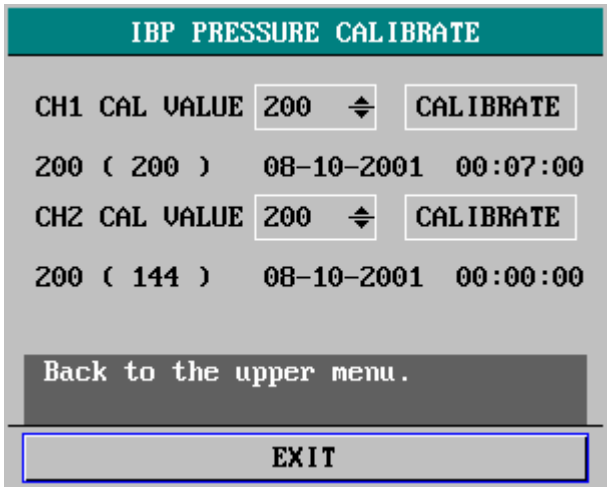


Figure 5-10 IBP Calibration Menu

Calibrate the transducer:

Turn the knob to select the item CH1 CAL VALUE, press and turn the knob to select the pressure value to be calibrated for channel 1. Then turn the knob to select the item CALIBRATE to start calibrating channel 1.

Turn the knob to select the item CH2 CAL VALUE, press and turn the knob to select the pressure value to be calibrated for channel 2. Then turn the knob to select the item CALIBRATE to start calibrating channel 2.

- The pressure calibration of PM-9000

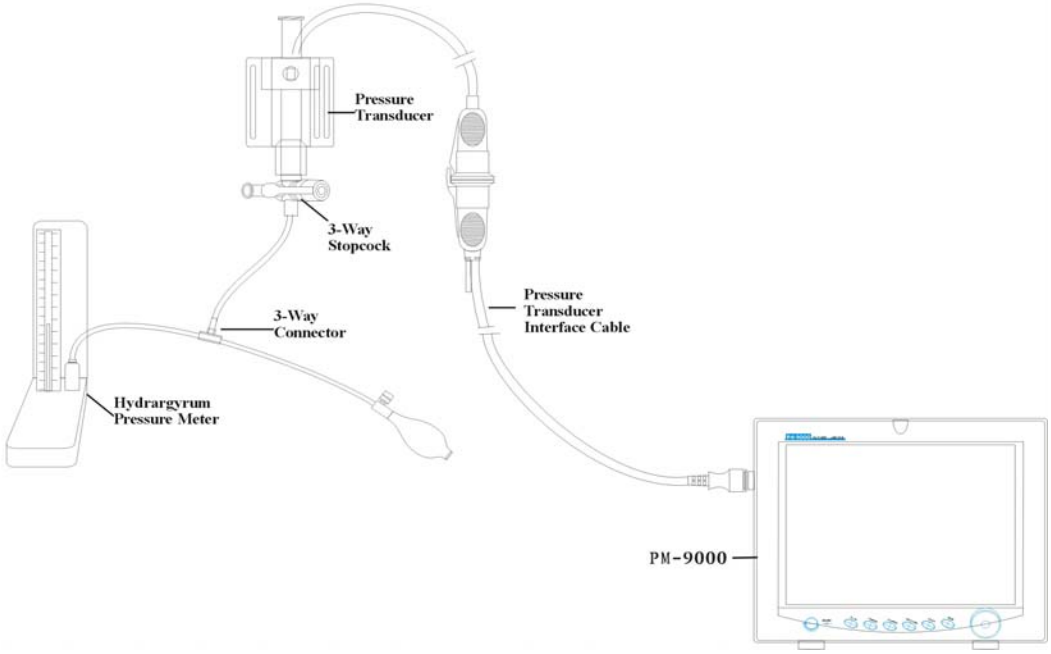


Figure 5-11 IBP Calibration

You will need the following pieces of equipment:

- Standard sphygmomanometer
- 3-way stopcock
- Tubing approximately 25 cm long

The Calibration Procedure:

1. Close the stopcock that was open to atmospheric pressure for the zero calibration.
2. Attach the tubing to the sphygmomanometer.
3. Ensure that connection that would lead to patient is off.
4. Connect the 3-way connector to the 3-way stopcock that is not connected to the patient catheter.
5. Open the port of the 3-way stopcock to the sphygmomanometer. .
6. Select the channel to be calibrated in the menu and select the pressure value to which the IBP is to be adjusted.
7. Inflate to make the mercury bar rise to the setup pressure value.
8. Adjust repeatedly until the value in the menu is equal to the pressure value shown by the mercury calibration.
9. Press the Start button, the device will begin calibrating.
10. Wait for the calibrated result. You should take corresponding measures based on the prompt information.
11. After calibration, disassemble the blood pressure tubing and the attached 3-way valve.

Calibration completion message:
“SUCCESSFUL CALIBRATE”

5.6 CO2 CHECK

Check procedure for sidestream module only

Via the PM-9000’s system and maintain menus you are prompted for a password for entering the factory key. After entering the password “332888” you get access to the pump rate settings and to check the accuracy of the CO2 measurement. Using the below test set up to verify the accuracy of the CO2 module.

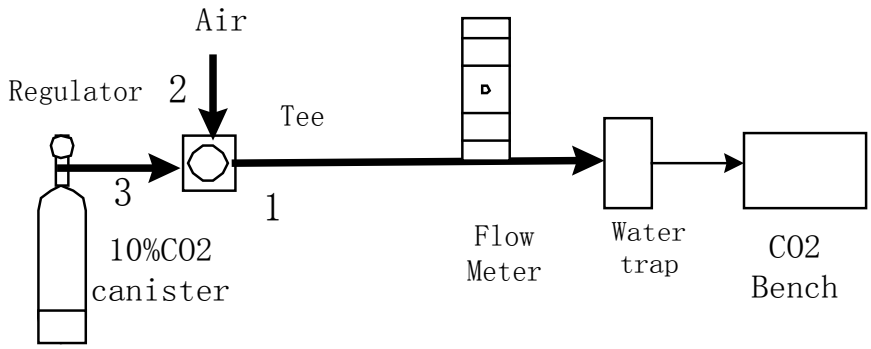


Figure 5-12 Sidestream test set up

⚠ **Note** ⚠ Neither the mainstream nor the sidestream module can be calibrated. Only the overall performance and accuracy is checked. If the Co2 module fails the tests it should be replaced.

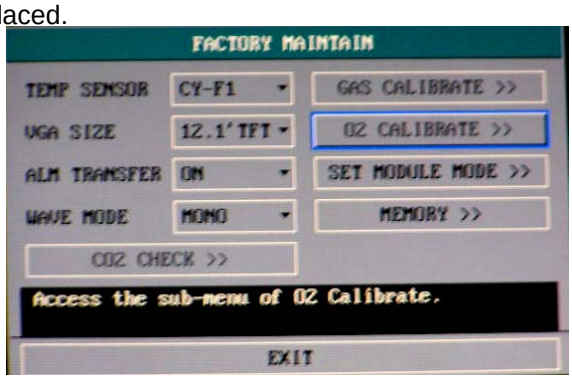


Figure 5-13 Factory Maintain Menu

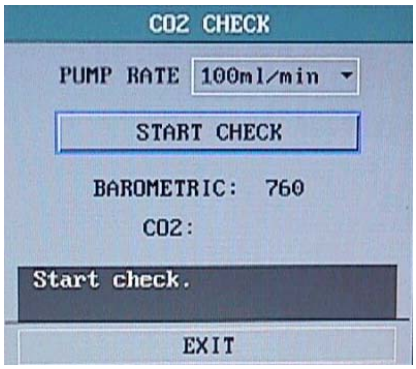


Figure 5-14 CO2 check menu

5.7 AG CALIBRATE

5.7.1 AG check

1、Using T-piece to connect the watertrap and Agent steel bottle well. One of the T-piece ports must be vented to atmospheric pressure.
2、Select ‘MEASURE’ from work mode item in “factory maintain” menu, then set pump rate ‘low’ and wait for 10 minutes after the warm up information disappears.
3、Enter ‘CALIBRATE’ menu, then open AG bottle and press the ‘VERIFY ACCURACY’ item.

Figure 5-15 AG Check Menu

4、Observe the display value after 1 minute. The agent concentration accurate should be less than ±5%.

5、 Choose other pump rate ‘middle’ or ‘high’，and repeat the previous procedures.

(pump rate definition: three pump rate under adult mode: 100/150/200ml/min; neonate: 70/90/110 ml/min）

6、If the accurate over range, please press ‘START CAL’.

5.7.2 AG CALIBRATE（Agent>1.5%, CO2>1.5%, N2O>40%, O2>40% ）

1、Press ‘START CAL’, then input password ‘MINDRAY’ entering ‘CALIBRATE’ menu.

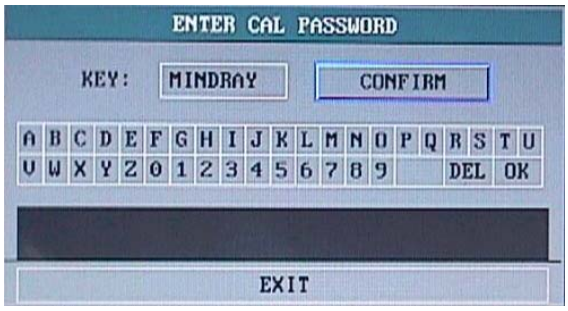


Figure 5-16

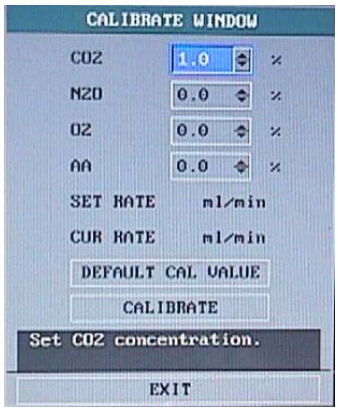


Figure 5-17

2、Input each gas concentration value according to the label on the AG bottle label.

3、Open AG cover, wait for the display value stabilization.

4、If the display value does not accord with the input value, please press ‘CALIBRATE’ item and exit.

AG concentration must fit the following requirements:

Agent>1.5%, CO2>1.5%, N2O>40%, O2>40%

Chapter 6 Structure and Part list

6.1Explosive view

TFT assembly

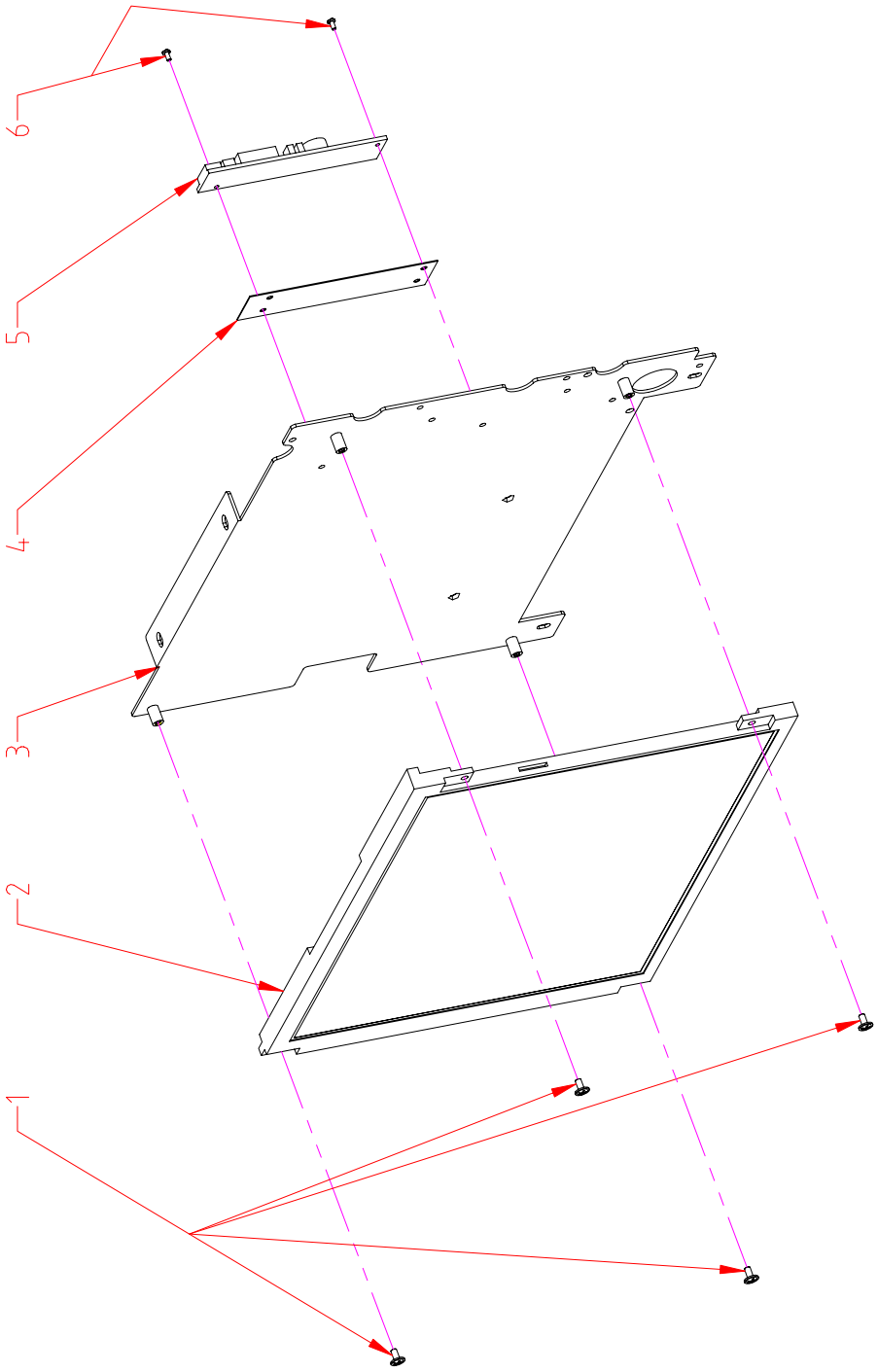


Figure 6-1: TFT assembly

No.	Standard No.	Name and SPEC.	QTY.
1	M04-004012---	Cross panhead screwe with washer M3×6	4
2	0010-10-12271	12.1' TFT screen	1
3	9200-10-10704	Display bracket	1
4	9200-20-10519	Insulating piece of backlight board (1)	1
5	900E-10-04913	INVERTOR CXA-L0612-VJL 'TDK'	1
6	M04-051001-01	SCREW GB818-86 M3×4	2

Socket assembly

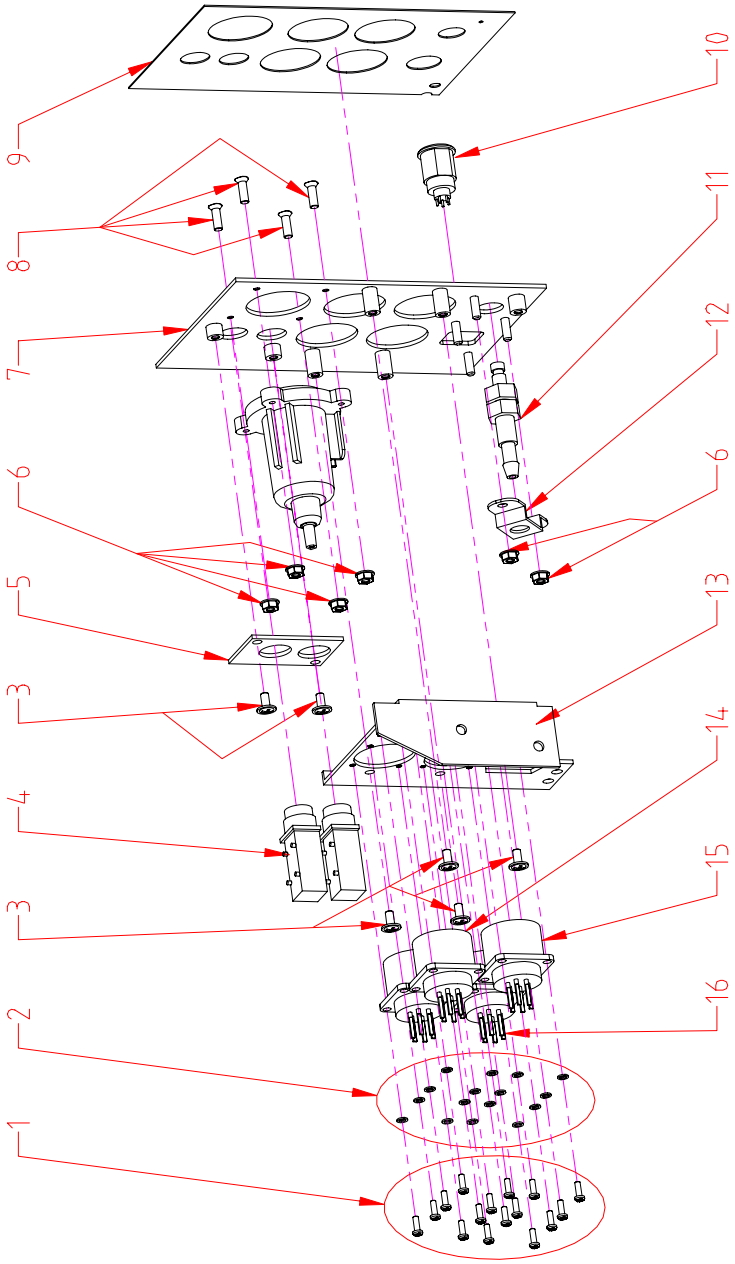


Figure 6-2: Socket assembly

No.	Standard No.	Name and SPEC.	QTY.
1	M04-002405---	SCREW GB818-86 M2×6	16
2	M04-000102---	WASHER GB97.2 2	16
3	M04-004012---	Cross panhead screw with washer M3×6	6
4	DA8K-20-14505	2- Channel TEMP signal wire	1
5	9000-20-05104	TEMP probe pad	1
6	M04-011002---	M3 nut with dented washer	1
7	9200-20-10510	Front retaining plate of probe	1
8	M04-000105---	SCREW GB819-85 M3×8	4
9	9000-20-07281	Probe label 1	1
10	9200-21-10437	SPO2 signal wire	1
11	509B-10-06191	Connector 20SFTS04M×N	1
12	9000-20-05205	NIBP retaining board	1
13	9200-20-10491	Rear retaining plate of probe	1
14	0010-20-12301	IBP signal wire	2
15	0010-20-12308	CO signal wire	1
16	0010-20-12207	ECG signal wire	1

Rear panel Assembly

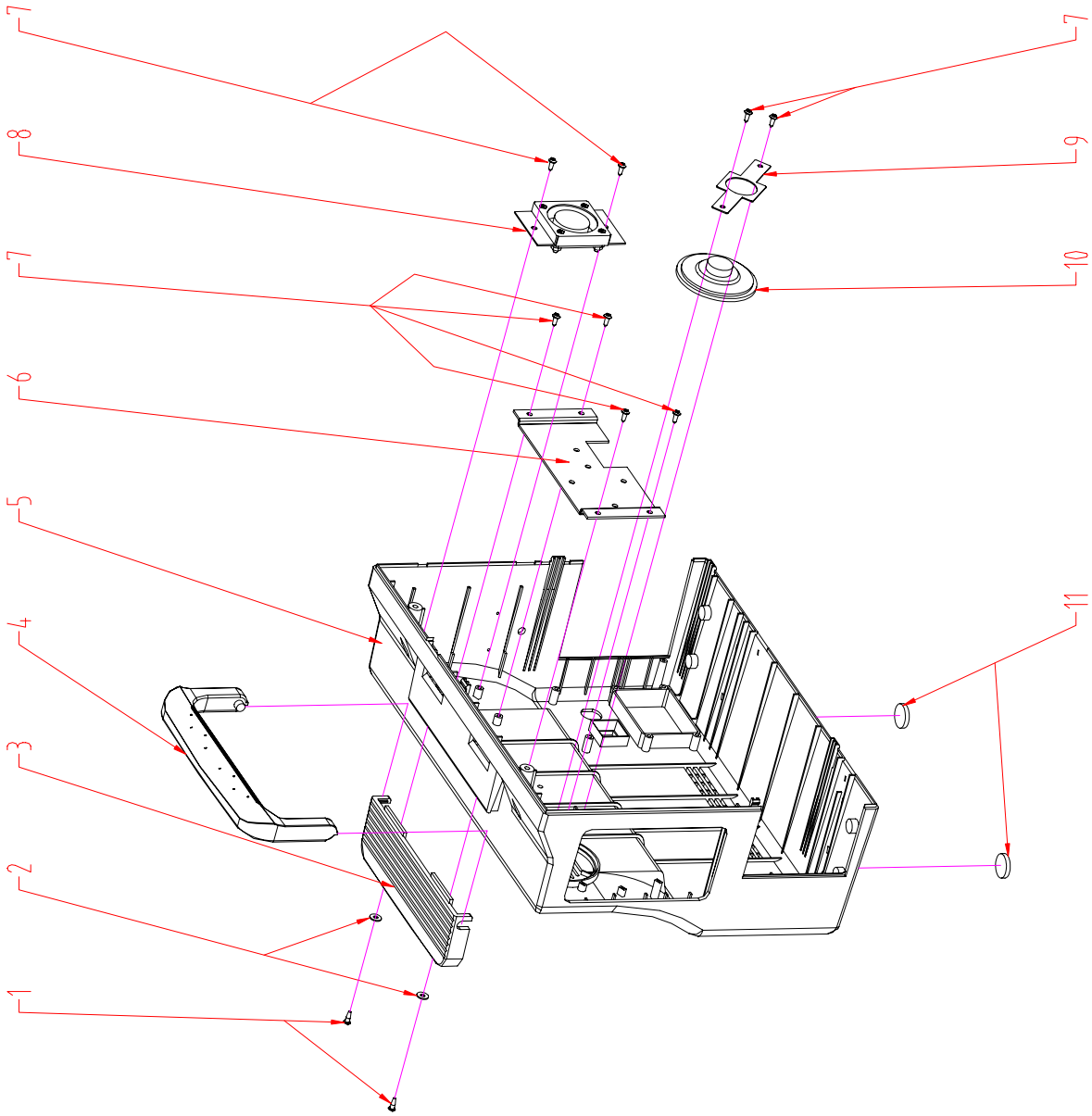


Figure 6-3: Rear panel Assembly

No.	Standard No.	Name and SPEC.	QTY.
1	M04-000305---	SCREW GB845-85 M3×12	2
2	M04-000802---	WASHER GB97.2 3	2
3	9000-20-07348	Press cover II	1
4	9200-20-10478	Handle III	1
5	9000-20-07346	Housing II	1
6	9200-20-10622	Wall mounting plate	1
7	M04-003105---	SCREW GB845-85 M3×8	8
8	9200-30-10522	Fan assembly	1
9	9200-20-10620	Press flake of speaker	1
10	9200-21-10633	2.25'' speaker and its connecting wire	1
11	9200-20-10511	Foot (1)	1

Front Panel Assembly

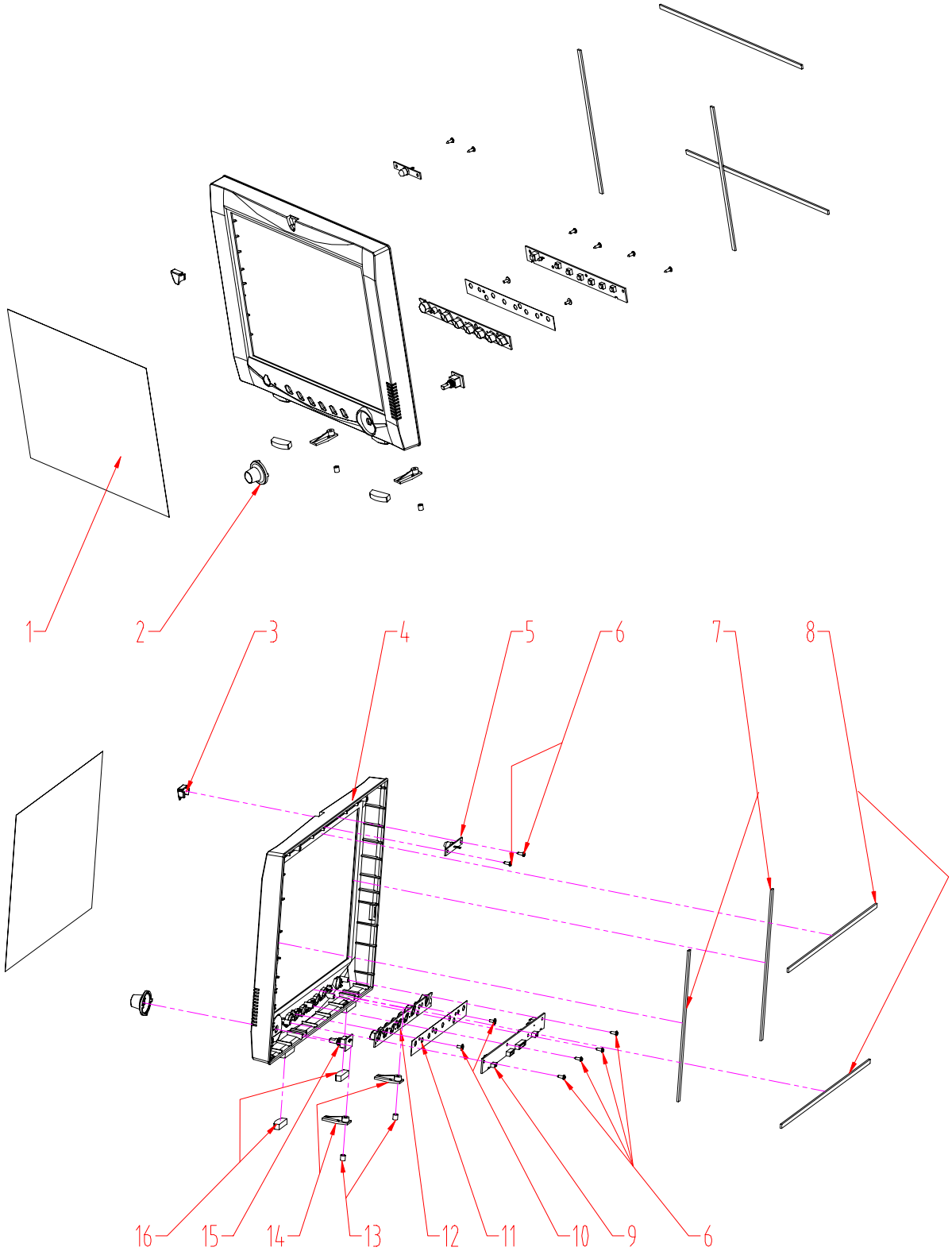


Figure 6-4: Front Panel Assembly

No.	Standard No.	Name and SPEC.	QTY.
1	9200-20-10548	12.1' TFT front panel	1
2	8000-20-10205	Knob	1
3	9200-20-10474	Alarm light lens	1
4	9200-20-10469	Front bezel	1
5	9200-30-10471	Alarm light plate	1
6	M04-003105---	SCREW GB845-85 M3×8	6
7	9200-20-10514	Dustproof pad (2)	2
8	9200-20-10513	Dustproof pad (1)	2
9	9200-30-10461	Keypad	1
10	M04-051004---	Cross panhead tapping screw M2.6×6	2
11	9200-20-10473	Support plate of key	1
12	9200-30-10698	Key board(Pitch tone)	1
13	M04-011004---	Copper nut Φ3×6	2
14	900E-20-04892	Connecting block	2
15	9200-30-10470	Encoder board	1
16	900E-20-04892	Connecting block	2

Whole unit Assembly

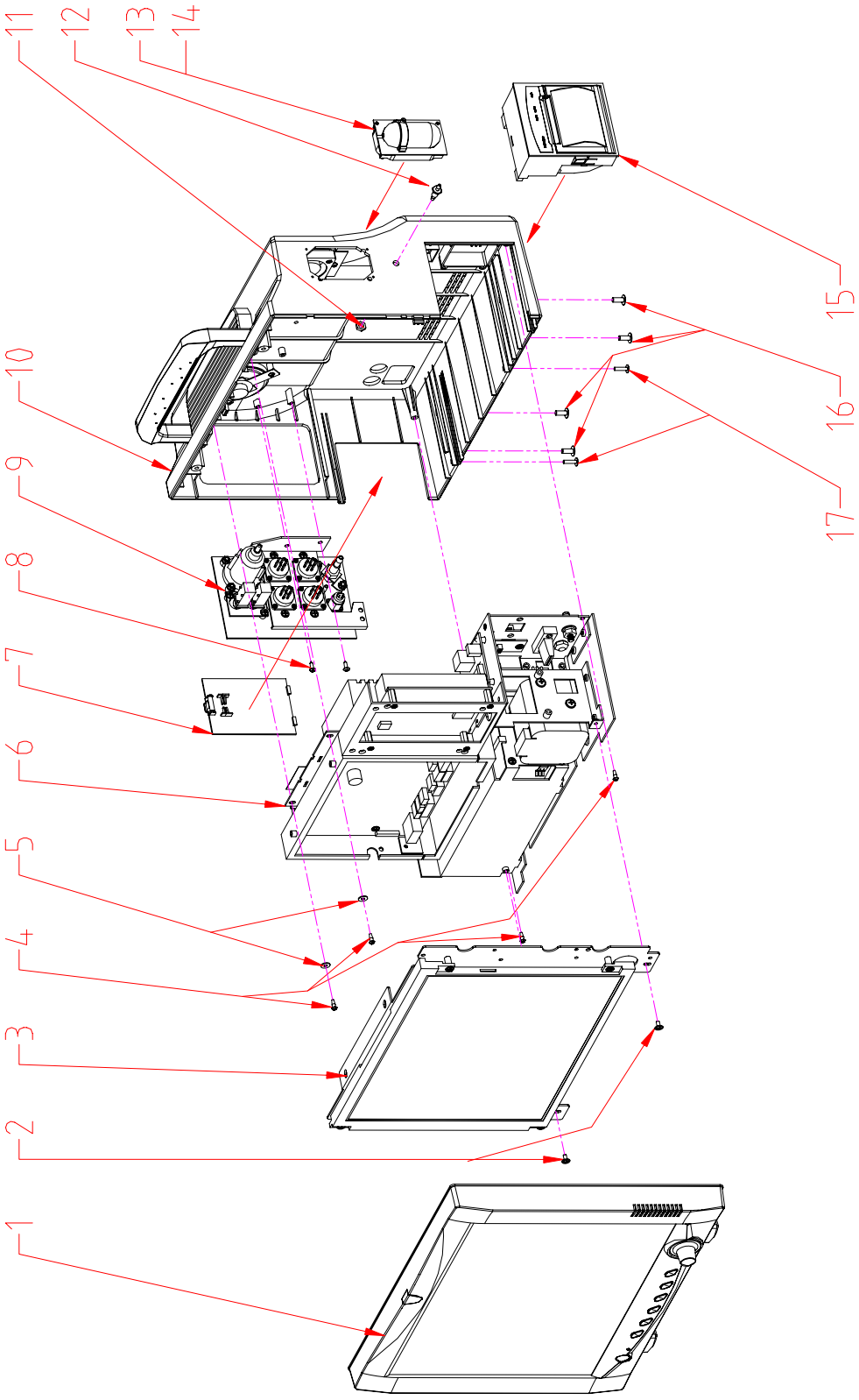


Figure 6-5: Whole unit Assembly

No.	Standard No.	Name and SPEC.	QTY.
1	9200-30-10468	12.1’ front bezel assembly	1
2	M04-004012---	Cross panhead screw with washer M3×6	2
3	9200-30-10706	TFT screen assembly	1
4	M04-000305---	SCREW GB845-85 M3×12	4
5	M04-000802---	WASHER GB97.2 3	2
6	9200-30-10482	Bracket assembly	1
7	9200-20-07353	Battery door II	1
8	M04-003105---	SCREW GB845-85 M3×8	2
9	9200-30-10487	6PIN probe socket assembly	1
10	9200-30-10475	Housing assembly	1
11	M04-000501---	NUT GB6170-M5	1
12	TR6C-30-16657	TR60-C recorder module bag	1
13	9200-10-10556	System Tubing PUR1.4/2.8	1
14	9200-10-10557	System Tubing PUR2.24/4.4	1
15	TR6C-30-16654	TR60-Crecorder	1
16	M04-004014---	Cross panhead screw with washer M4×10	4
17	M04-004017---	Cross panhead screw with washer M3×12	2

Main Bracket Assembly

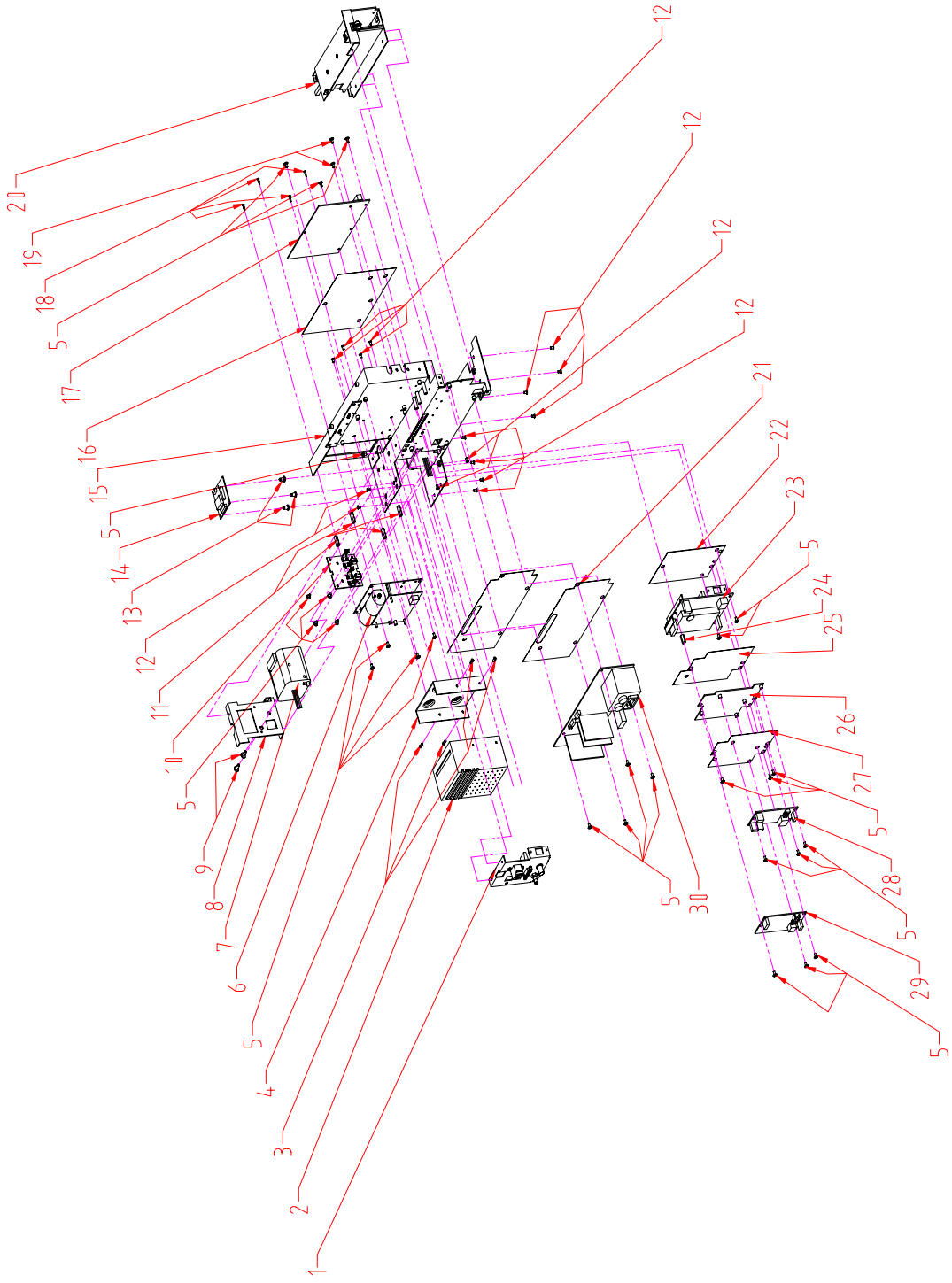


Figure 6-6: Main Bracket Assembly

No.	Standard No.	Name and SPEC.	QTY.
1	9200-30-10479	Socket board assembly	1
2	9200-10-10529	Aion AG module	1
3	M04-000405---	SCREW GB819-85 M3×8	4
4	9200-20-10527	Mounting plate of AG module	1
5	M04-004012---	Cross panhead screw with washer M3×6	27
6	630D-30-09111	630D NIBP host	1
7	9200-10-10531	Aion O2 module	1
8	9200-20-10485	Mounting plate of printer	1
9	M04-006512---	Cross screw with washer M4×6	2
10	9000-30-05178	Backboard of battery	1
11	9200-20-10528	Support post	4
12	M04-005005---	SCREW GB819-85 M3×6	16
13	M90-100062---	Isolating rod between boards SCE-6 by “PIONEER-TECH Company Limited”	3
14	9200-30-10532	Adapting plate of anesthesia signal	1
15	9200-20-10483	Bracket	1
16	9200-20-10545	Insulating piece of main control board	1
17	CS9K-30-16531	Main control board(4M)	1
18	M04-051009-00	SCREW GB819-85 M2.5×5	4
19	M04-002505---	SCREW GB818-86 M3×6	2
20	9200-30-10492	Battery compartment assembly	1
21	9200-20-10515	Insulating piece of power board	1
22	9200-20-10516	Insulating piece of ECG board	1
23	0812-30-08544	812 ECG board	1
24	M04-06009---	Stud screw M3×14	1
25	9200-20-10518	Insulating piece of mounting plate (2)	1
26	9200-20-10503	SPO2/IBP mounting plate	1
27	9200-20-10517	Insulating piece of mounting plate (1)	1
28	M03A-30-26050	M03A CO/IBP board	1
29	9005-30-08530	9005 SPO2 board	1
30	9200-30-10489	Power board	1

6.2 Dis and reassembly procedures

Removing the front cover

- Unscrew the two screws next to the handle
- Unscrew the two screws at the bottom closest to the front panel
- Carefully lift of the front cover and remove the two connectors
- Reassemble in reverse order

Removing the rear cover

- Unscrew the remaining 4 screws at the bottom of the cover
- Unscrew the screw just below the mains inlet accessible under the left side of the display
- Unscrew the screw next to the earth connector under the right side of the display
- Unscrew the two screws above the display
- Carefully slide out the monitor assembly from the rear cover, taking care not to stress the harness from the patient input panel
- Disconnect the connector for the fan
- Unscrew the two screws holding the patient input panel and slide out the panel
- Reassemble in reverse order

Removing the Display panel

- Unscrew the two screws below the actual LCD display
- Carefully lift up the display
- Disconnect the connectors for the display and back light converters

Reassemble in reverse order

6.3 Part List

No.	Standard No.	Name and SPEC.	QTY.
1	0010-10-12271	12.1' TFT screen	1
2	9200-20-10497	Display bracket	1
3	900E-10-04913	INVERTOR CXA-L0612-VJL 'TDK'	1
4	DA8K-20-14505	TEMP signal wire	1
5	9200-21-10437	SPO2 signal wire	1
6	0010-20-12301	IBP signal wire	2
7	0010-20-12308	CO signal wire	1
8	0010-20-12207	ECG signal wire	1
9	9200-20-10478	Handle III	1
10	9000-20-07346	Housing II	1
11	9200-20-10622	Wall mounting plate	1
12	9200-30-10522	Fan assembly	1
13	9200-21-10633	2.25'' speaker and its connecting wire	1
14	9200-20-10511	Foot (1)	1
15	9200-20-10548	12.1' TFT front panel	1
16	8000-20-10205	Knob	1
17	9200-20-10474	Alarm light lens	1
18	9200-20-10469	Front bezel	1
19	9200-30-10471	Alarm light plate	1

20	9200-20-10514	Dustproof pad (2)	2
21	9200-20-10513	Dustproof pad (1)	2
22	9200-30-10461	Keypad	1
23	9200-20-10473	Support plate of key	1
24	9200-30-10698	Key board(Pitch tone)	1
25	900E-20-04892	Connecting block	2
26	9200-30-10470	Encoder board	1
27	900E-20-04892	Connecting block	2
28	9200-30-10468	12.1' front bezel assembly	1
29	9200-30-10706	TFT screen assembly	1
30	9200-30-10482	Bracket assembly	1
31	9200-20-07353	Battery door II	1
32	9200-30-10487	6PIN probe socket assembly	1
33	9200-30-10475	Housing assembly	1
34	TR6C-30-16657	TR60-C recorder module bag	1
35	9200-30-10479	Socket board assembly	1
36	9200-10-10529	Aion AG module	1
37	630D-30-09111	630D NIBP host	1
38	9200-10-10531	Aion O2 module	1
39	9000-30-05178	Backboard of battery	1
40	9200-20-10528	Support post	4
41	CS9K-30-16531	Main control board(4M)	1
42	0812-30-08544	812 ECG board	1
43	M03A-30-26050	M03A CO/IBP board	1
44	9005-30-08530	9005 SPO2 board	1
45	9200-30-10489	Power board	1
46	M02A-30-25901	Mindray CO2 board	1

Chapter 7 Maintenance Menu

Passwords

All the related passwords are as follows:
USER KEY: MINDRAY
FACTORY KEY: 332888
DEMO: 2088.

How to set maintain MENU

Select “MAINTAIN” item in “SYSTEM MENU” access “ENTER MAINTAIN PASSWORD” dialog box as shown below, in which the user may enter MINDRAY and set up the user-defined maintenance settings. Or the appointed personnel may enter password 332888 and execute the factory maintenance function.

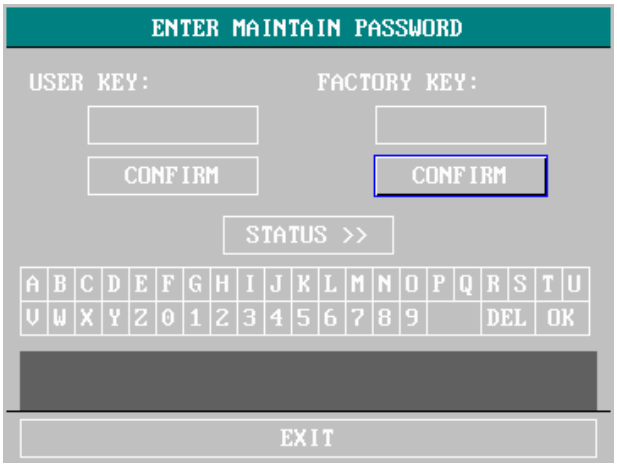

ENTER MAINTAIN PASSWORD
USER KEY:
FACTORY KEY:
CONFIRM
CONFIRM
STATUS >>
A B C D E F G H I J K L M N O P Q R S T U
V W X Y Z 0 1 2 3 4 5 6 7 8 9
DEL
OK
EXIT

Figure 7-1 Enter maintain password

Language Select

Enter USER MAINTAIN menu, then select the right Language from dialog box

OPEN/CLOSED ALARM SOUND

Enter USER MAINTAIN menu, select “ON” in alarm sound dialog box
to open alarm sound. Select “OFF” in alarm sound dialog box to close alarm sound.

SET NET Number

Enter USER MAINTAIN menu, select CMS from the net type dialog box.
NOTE: The type of“HYPER III” maximally connect 8 bed
monitors. At the time, the number which in BED NO. only be adjusted From 1 to 8.
The type of“CMS” maximally connect 64 bed monitors.
At the time, the number which in BED NO. can be adjusted From 1 to 64.).
Note: Each patient monitor has unique bed number when the monitors connect to a center monitor system.

COLOR SELF-DEFINE

This is used by the user to define the color of the waveform displayed on the screen. Five colors can be chosen from: green, cyan, red, yellow and white.

COLOR DEFINE

Enter USER MAINTAIN menu, then enter the color self-define sub-menu. Each waveform and parameter has 5 color can be selected.

FACTORY MAINTAIN

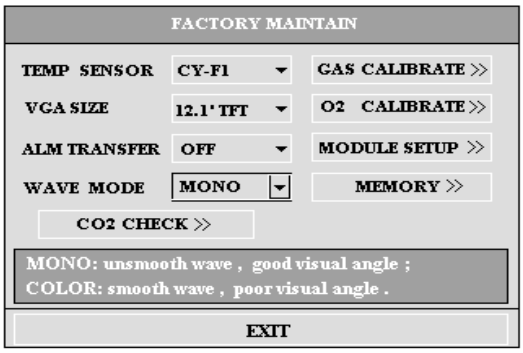


Figure 7-2 Factory maintain

TEMP SENSOR

Two selections are available: CY-F1 and YSI. If it is set to CY-F1, only Mindray's temp sensor can be used. If it is set to YSI, only YSI's 400 series temp sensor can be used.

Make sure the temp sensor type to match the temp sensor being used, otherwise it doesn't work or the reading is incorrect.

VGA SIZE

You have to select the right size according to the TFT size being used.

ALM TRANSFER

This function is not available now.

WAVE MODE

Two selections are available: MONO and COLOR. The waveform displayed will be different correspondingly.

CO2 CHECK

This is to check CO2 module,please refer to Chapter 5 Tests for detailed information.

GAS CALIBRATE

This is to calibrate GAS module, please refer to Chapter 5 Tests for detailed information.

O2 CALIBRATE

This is to calibrate O2 module, please refer to Chapter 5 Tests for detailed information.

MODULE SETUP

In this menu, you can enable or disable all the modules equipped inside monitor.

After you upgrade a new function, you should enter this menu and enable this function, otherwise this function will not work.

MEMORY

This menu is for only Mindray's personnel.

Chapter 8 Maintenance and Cleaning

⚠ **Warning** ⚠ **Before cleaning the monitor or the sensor, make sure to turn off the power and disconnect the AC power.**

8.1 Maintenance checks

Before using the monitor, do the following:

1. Check if there is any mechanical damage;
2. Check all the outer cables, inserted modules and accessories;
3. Check all the functions of the monitor to make sure that the monitor is in good condition.

If finding any damage on the monitor, stop using the monitor on patient.

4. The overall check of the monitor, including the safety check, should be performed only by qualified person once each time after fix up.

8.2 General cleaning

1. The PM-9000 Patient Monitor must be kept dust-free.
2. It is recommended to regularly cleaning the monitor shell and the screen. Use only non-caustic detergents such as soap and water.

⚠Note ⚠

Please pay special attention to the following items to avoid damaging PM-9000:

1. Avoid using ammonia-based or acetone-based cleaners such as acetone.
2. Most cleaning agents must be diluted before use. Follow the manufacturer's directions carefully for dilution.
3. Don't use the grinding material, such as steel wool etc.
4. Don't let the cleaning agent enter into the chassis of the system. Do not emerge any part of the device into any liquid.
5. Don't leave the cleaning agents on any part of the device surface.
6. **Except for those cleaning agents listed in “NOTE” part, following disinfectants can be used on the instrument:**

Diluted Ammonia Water

Diluted Sodium Hyoichlo (Bleaching agent).

⚠ Note ⚠

The diluted sodium hyoichlo from 500ppm(1:100 diluted bleaching agent) to 5000ppm (1:10 bleaching agents) is very effective. The concentration of the diluted sodium hyocihlo depends on how many organisms (blood, mucus) on the surface of the chassis to be cleaned.
Diluted Mindrayhylene Oxide 35% -- 37%
Hydrogen Peroxide 3%
Alcohol
Isopropanol

⚠ Note⚠

PM-9000 monitor and sensor surface can be cleaned with hospital-grade ethanol and dried in air or with crisp and clean cloth.

⚠ Note⚠

Mindray has no responsibility for the effectiveness of controlling infectious disease using these chemical agents. Please contact infectious disease experts in your hospital for details.

8.3 Sterilization

To avoid extended damage to the equipment, sterilization is only recommended when stipulated as necessary in the Hospital Maintenance Schedule. Sterilization facilities should be cleaned first.

Recommended sterilization material: Ethylate, and Acetaldehyde.

⚠ **Caution** ⚠

1. Follow the manufacturer's instruction to dilute the solution, or adopt the lowest possible density.
2. Do not let liquid enter the monitor.
3. No part of this monitor can be subjected to immersion in liquid.
4. Do not pour liquid onto the monitor during sterilization.
5. Use a moistened cloth to wipe off any agent remained on the monitor.
6. To avoid extended damage to the equipment, disinfecting is only recommended when stipulated as necessary in the Hospital Maintenance Schedule. Disinfecting facilities should be cleaned first.
Appropriate disinfecting materials for ECG lead, SpO_2 sensor, blood pressure cuff, TEMP probe, IBP sensor are introduced Operation Manual respectively.

⚠ **Caution** ⚠

Do not use EtO gas or formaldehyde to disinfect the monitor.

8.4 Preventative maintenance

After use

Clean the monitor by using a non-aggressive solution with a slightly damp cloth. Care should be taken to prevent liquid from entering the monitor.

Check all accessories, cables, etc. for damage and replace if necessary. Check that the fan on the rear of the monitor is functional.

Annual service routine

Check the cabinet for damage.

Perform a calibration of the CO2 and AG modules.

Perform a calibration of the NIBP module

Perform a full functional test of the monitor as described in the Chapter 5

Perform a safety test

8.5 Cuff maintenance and cleaning

⚠ Warning ⚠

1. Do not squeeze the rubber tube on the cuff.

2. Do not allow liquid to enter the connector socket at the front of the monitor to avoid damaging the monitor.

3. Do not wipe the inner part of the connector socket when cleaning the monitor. Wipe the outside its surface only.

4. When the reusable cuff is not connected with the monitor, or being cleaned, always place the cover on the rubber tube to avoid liquid permeation.

5. Reusable Blood Pressure Cuff

The cuff can be sterilized by means of conventional autoclaving, gas, or radiation sterilization in hot air ovens or disinfected by immersion in decontamination solutions, but remember to remove the rubber bag if you use this method. The cuff should not be dry-cleaned.

The cuff can also be machine-washed or hand-washed, the latter method may extend the service life of the cuff. Before washing, remove the latex rubber bag. Allow the cuff to dry thoroughly after washing and then reinsert the rubber bag.

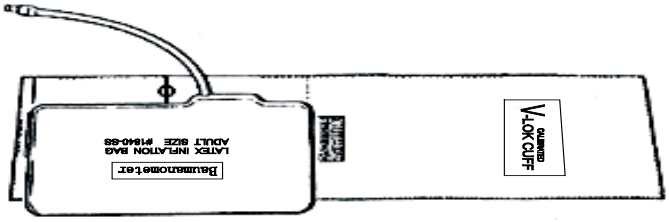


Figure 8-1 Cuff

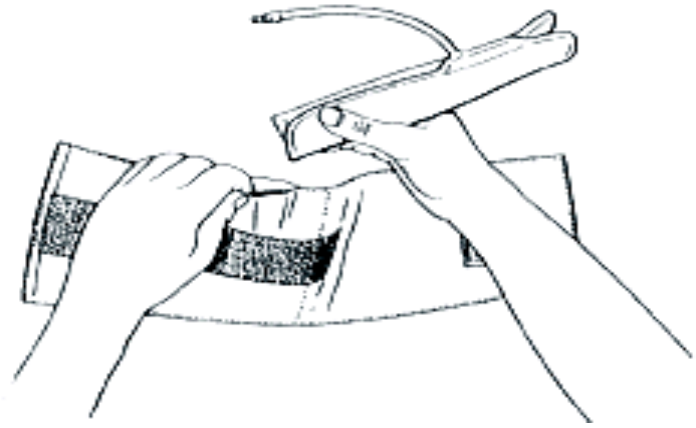


Figure 8-2 Replace the rubber bag in the cuff

To replace the rubber bag in the cuff, first place the bag on top of the cuff so that the rubber tubes line up with the large opening on the long side of the cuff. Now roll the bag lengthwise and insert it into the opening on the long side of the cuff. Hold the tubes and the cuff and shake the complete cuff until the bag is in position. Thread the rubber tubes from inside the cuff, and out through the small hole under the internal flap.

6 Disposable cuffs are intended for one-patient use only. Do not use the same cuff on any other patient. Do not sterilize or use autoclave on disposable cuffs. Disposable cuffs can be cleaned using soap solution to prevent infection.

⚠**Note** ⚠

For protecting environment, the disposable blood pressure cuffs must be recycled or disposed of properly.

8.6 IBP transducer cleaning and disinfection（reusable）

After the IBP monitoring operation is completed, remove the tubing and the dome from the transducer and wipe the transducer diaphragm with water. Soaking and/or wiping with soap can clean the transducer and cable and water or cleaning agents such as those listed below:

Cetylcide

Wavicide-01

Wescodyne

Cidex

Lysol

Do not immerse the connector in any liquid. After cleaning, dry the transducer thoroughly before storing. Slight discoloration or temporary increase of surface stickiness of the cable should not be considered abnormal If adhesive tape residue must be removed from the transducer cable, double seal tape remover is effective and will cause a minimum of damage to the cable if used sparingly. Acetone, Alcohol, Ammonia and Chloroform, or other strong

solvents are not recommended because over time the vinyl cables will be damaged by these agents.

⚠ Note ⚠

The disposable transducers or domes must not be re-sterilized or re-used.

⚠**Note** ⚠

For protecting environment, the disposable transducers or domes must be recycled or disposed of properly.

Liquid Chemical Sterilization

Remove obvious contamination by using the cleaning procedure described previously. Select a sterilant that your hospital or institution has found to be effective for liquid chemical sterilization of operating room equipment. Buffered gluteraldehyed (e.g. Cidex or Hospisept) has been found to be effective. Do not use quaternary cationic detergents such as zephiran chloride. If the whole unit is to be sterilized, immerse the transducer but not the electrical connector into the sterilant for the recommended sterilizing period. Be sure that the dome is removed. Then rinse all transducer parts except the electrical connector with sterilized water or saline. The transducer must be thoroughly dried before storing.

Gas Sterilization

For more complete asepsis, use gas sterilization.

Remove obvious contamination by using the cleaning procedure described previously. To inhibit the formation of ethylene glycol when ethylene oxide gas is used as the disinfectant, the transducer should be completely dry.

Follow the operating instructions provided by the manufacturer of the gas disinfectant.

⚠ Warning ⚠

The sterilize temperature must not exceed 70°C (158°F). Plastics in the pressure transducer may deform or melt above this temperature.

8.7 TEMP sensor cleaning and disinfection (reusable)

1. The TEMP probe should not be heated above 100℃ (212℉). It should only be subjected briefly to temperatures between 80℃ (176℉) and 100℃ (212℉).
2. The probe must not be sterilized in steam.
3. Only detergents containing no alcohol can be used for disaffection.
4. The rectal probes should be used, if possible, in conjunction with a protective rubber cover.

5. To clean the probe, hold the tip with one hand and with the other hand rubbing the probe down in the direction of the connector using a moist lint-free cloth.

⚠Note ⚠

Disposable TEMP probe must not be re-sterilized or reused.

⚠ **Note** ⚠

For protecting environment, the disposable TEMP probe must be recycled or disposed of properly.

8.8 SpO_2 sensor cleaning and disinfection

⚠ Warning ⚠

Do not subject the sensor to autoclaving.
Do not immerse the sensor into any liquid.
Do not use any sensor or cable that may be damaged or deteriorated.

1. Use a cotton ball or a soft mull moistened with hospital-grade ethanol to wipe the surface of the sensor, and then dry it with a cloth. This cleaning method can also be applied to the luminotron and receiving unit.
2. The cable can be cleaned with 3% hydrogen dioxide, 7% isopropanol, or other active reagent. However, connector of the sensor shall not be subjected to such solution.

8.9 CO2 sensor cleaning

1. Sample line is for one-off use in SideStream module. Do not sterilize or clean for reuse on another patient.
2. Airway adapter is for one-off use in MainStream module. Do not sterilize or clean for reuse on another patient.
3. Watertrap is for one-off use in SideStream module. Do not sterilize or clean for reuse on another patient.
4. When the sample system of Sidestream module occurring occlusion, first check kinks for sampling line. If no kinks are found, then check water trap after disconnecting sample line from the Watertrap. If the occlusion message on the screen disappears, the sampling line must be replaced. If the occlusion message on the screen remains, the Watertrap must be replaced.
5. No routine calibration required in both Mainstream and Sidestream CO2 module.

8.10 AG sensor cleaning

AG module

For detailed cleaning information about “AG Module”, refer to the chapter of “Maintenance and Cleaning” in this operation manual.

Bacteria filter

The bacteria filter is one-off type, i.e., one bacteria filter can only be used by one patient.

Sample line

The sample line is one-off type.

Watertrap

The watertrap is reusable. You need to replace it one month or it’s damaged.

Gas exhaust outlet

The gas exhaust outlet is reusable. You need to replace it only when it is damaged or becomes loosely connected. This tube can be cleaned and disinfected.

Cleaning: use cloth moistened with warm soap water to clean the tube. Do not immerse the tube into the liquid.

Disinfection: use cloth moistened with cool chemical disinfector (ramification mainly containing aldehyde, ethanol or ramification mainly containing ethanol) to clean the tube. Do not immerse the tube into the liquid. After cleaning, use wet cloth to wipe off the disinfector and then use dry cloth to wipe the tube.

Occlusion handling

If the AG module passage is occluded, the screen will display the message “AG OCCLUSION”. Following are a few examples of occlusion, which you may remove one by one until this message disappears.

Entrance Occlusion

If the part at the entrance such as filter, sample line or airway connector is occluded by condensed water, the screen will display the message telling that the airway is occluded.

The optimal method to remove clogs of this kind is:

check for clogs in entrance parts:

replace the bacteria filter at the entrance;

check the sample pipe for clogs and/or entangle. If necessary, replace it.

Check the airway connector for water. If necessary, drain off the water and install the connector again.

Internal Occlusion

If the interior of the AG module is contaminated by condensed water, the screen will also display the message telling that the airway is occluded.

The optimal method to remove clogs of this kind is:

Step 1: as usual, check the entrance or the exit for clogs and remove them.

Step 2: if occlusion still persist after step 1, you should consider the existence of interior occlusion. In this situation, contact service engineer.

Appendix A

Troubleshooting and System Alarm Prompt

PM-9000 Module-level Service Table

Device Failures

Failure	Possible cause	Solution
No display after power-on, power indicator does not light on, fan does not run.	1. Fuse blown 2. Power module failure	Replace fuse Replace Power module
No display after power-on or black screen during operation, however, power indicator lights on and fan runs normally.	Main Control module failure or display failure	Replace Main Control module Replace display module
Characters are displayed normally, however waveforms are displayed intermittently.	Data communication error between Main Control module and Parameter module	Replace Main Control module Replace actual Parameter module.
An operation or measurement function is disabled.	Main Control module failure	Replace Main Control module
Device is occasionally frozen.	1. Intermittent interference of network 2. Poor performance of Power module 3. Poor performance of Main Control module 4. Bad connection of Power module or Main Control module	1. Check power supply and grounding system 2. Replace Power module 3. Replace Main Control module 4. Replace or repair connectors

Display Failures

Failure	Possible cause	Solution
When powering on the device, power supply is in normal operation, however, there is no display or screen goes black during normal operation.	1. Backlight module damage	1. Connect external VGA display and confirm the failure. Replace backlight module(s)
	2. Bad connecting wire of display	2. Repair or replace connecting wire
	3. Damage of Main Control module	3. Replace Main Control module

Operation, Recording, Network Linking Failures

Failures	Possible cause	Solution
Keys or rotary encoder is disabled.	1. Keyboard or rotary encoder is damaged.	1. Replace keyboard or rotary encoder.
	2. Connecting wire of keyboard is damaged.	2. Replace or repair connecting wire of keyboard.
Sound is raucous or there is no sound.	1. Keyboard failure.	1. Replace keyboard.
	2. Speaker or connecting wire failure.	2. Replace speaker or connecting wire.
Recorder cannot execute printing operation.	1. Recorder has no paper or paper bail is not pressed down.	1. Install paper and press down the paper bail.
	2. Recorder failure.	2. Replace the recorder.
	3. Driving power of the recorder has failure.	3. Replace the Power module
	4. Connecting wire of the recorder is damaged.	4. Replace or repair the connecting wire of the recorder.
Record paper goes out misaligned	Bad recorder installing or positioning.	Adjust the installation of recorder.

Cannot be linked into network	1. Network linking wire is damaged. 2. Main Control module failure. 3. Incorrect bed number settings 4. HUB is faulty	1. Check and repair network-linking wire. 2. Replace main Control module. 3. Check bed number 4. Change to other input socket on HUB to check cabling or HUB problem.

Power Module Failures

Failure	Possible cause	Solution
Fuse is burned upon power-on	Short-circuit occurs in power supply or other part.	Replace Power module
Fuse is burned although all loads are disconnected.	Power failure	Replace power supply
Fuse is burned after connecting a module.	This module creates short-circuit.	Replace the module
Power indicator lights on, however, the fan does not run.	+12V DC power is damaged.	Replace the Power module
Power indicator does not light on, however, the fan runs normally	+5V DC power is damaged.	Replace the Power module

Parameter Failures

Failure	Possible cause	Solution
No ECG waveform	1. Poor connection of ECG electrodes 2. No square waveform exists during CAL self-test 3. RL electrode is suspended. 4. ECG/RESP module is damaged.	1. Use new electrode to ensure good contact. 2. Replace ECG/RESP module 3. Connect RL electrode. 4. Replace ECG/RESP module
ECG waveform is abnormal or has interference	1. Electrodes are connected incorrectly.	1. Correctly connect electrodes

	2. Dry electrode gel	2. Reapply gel or replace electrodes
	3. AC power has no grounding wire.	3. Use 3-wire power cord and Control mains outlet
	4. ECG filter mode is incorrect.	4. Select appropriate filter mode
	5. ECG/RESP module is damaged.	5. Replace ECG/RESP module
No RESP waveform or RESP waveform is abnormal	1. Electrodes are connected incorrectly.	1. Use RL-LL electrode, connect to the correct positions.
	2. Patient is moving.	2. Keep patient quiet
	3. ECG/RESP module is damaged.	3. Replace ECG/RESP module
TEMP value is incorrect	Measuring sensor is poorly connected. The setting of type is not correct.	Connect TEMP sensor correctly or replace sensor or correct the setting Replace TEMP module
HR value is inaccurate, Arr. and ST analysis are incorrect.	ECG waveform is not good.	Adjust the connection to make the ECG waveform become normal.
NIBP cuff cannot be inflated.	Hose is folded or has leakage. NIBP module is faulty	Adjust or repair the airway. Replace NIBP module
Blood pressure cannot be measured occasionally.	Cuff becomes loose or patient is moving.	Keep the patient quiet, position the cuff correctly and safely.
Error of blood pressure NIBP values are too high	Cuff size does not fit the patient. NIBP module has bad performance.	Use the cuff with appropriate size. Replace NIBP module
No SpO_2 waveform	Sensor or SpO_2 module is damaged.	Replace the sensor or SPO2 module.
SpO_2 waveform has strong interference.	1. Patient is moving.	1. Keep the patient quiet.

	2. Environment light is very intensive.	2. Weaken the light intensity in the environment.
No IBP waveform	Sensor or IBP module is damaged	Check sensor with second IBP channel. Replace sensor if necessary or replace IBP module
IBP waveform is erratic	Sensor is not properly set up	Check the connections between sensor and monitor. Check the drip stand connections and saline bags
IBP will not zero set	Applied pressure is too high	Check that sensor is open to ambient air pressure. If OK replace the IBP module
No CO waveform	Sensor or CO module is damaged	Replace sensor or replace CO module
CO calculations are erratic	CO module has bad performance	Replace CO module
No CO2 waveform, sidestream	Watertrap or sample line is leaking CO2 module is faulty Internal hoses are occluded	Replace accessories Replace CO2 module Replace internal hoses
No CO2 waveform, mainstream	IR sensor faulty CO2 module faulty	Replace IR sensor Replace CO2 module
CO2 waveforms are erratic	CO2 module has bad performance	Replace CO2 module

AG module indicates low or high concentrations, or a long rise time is encountered	Watertrap or sample line leaking	Replace accessories and perform a leak test
	Watertrap should be of correct type	Ensure the monitor detects the type. If not replace watertrap, or AG module
	AG module has bad performance	Perform a gas measurement check. If not OK replace the AG module

System Alarm Prompt

PROMPT	CAUSE	MEASURE
"XX TOO HIGH"	XX value exceeds the higher alarm limit.	Check if the alarm limits are appropriate and the current situation of the patient.
"XX TOO LOW"	XX value is below the lower alarm limit.	
XX represents the value of parameter such as HR, ST1, ST2, RR, SpO2, IBP, NIBP, etc in the system.		
"ECG WEAK SIGNAL"	The ECG signal of the patient is too small so that the system can not perform ECG analysis.	Check if the electrodes and lead wires are connected correctly and the current situation of the patient.
“NO PULSE”	The pulse signal of the patient is too small so that the system can not perform pulse analysis.	Check the connection of the sensor and the current situation of the patient.
"RESP APNEA"	The respiration signal of the patient is too small so that the system cannot perform RESP analysis.	Check the connection of the linking wire and the current situation of the patient.
"CO2 APNEA"	The respiration signal of the patient is too small so that the system cannot perform RESP analysis.	Check the connection of CO2 sensor and the current situation of the patient.
"ASYSTOLE"	Patient suffers from Arr. Of ASYSTOLE.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"VFIB/VTAC"	Patient suffers from Arr. of VFIB/VTAC.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"COUPLET"	Patient suffers from Arr. of COUPLET.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"BIGEMINY"	Patient suffers from Arr. Of BIGEMINY.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.

"TRIGEMINY"	Patient suffers from Arr. of TRIGEMINY.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"R ON T"	Patient suffers from Arr. of R ON T.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"PVC"	Patient suffers from Arr. of PVC.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"TACHY"	Patient suffers from TACHY.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
" BRADY"	Patient suffers from BRADY.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"VT>2"	Patient suffers from Arr. of VT>2.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
“MISSED BEATS”	Patient suffers from Arr. of MISSED BEATS.	Check the current situation of the patient. Check the connection of the electrodes and lead wires.
"PNP"	The pacemaker is not paced.	Check the connection of the pacemaker. Check the connection of electrodes and lead wires. Check the current situation of the patient.
"PNC"	No pacemaker signal is captured.	Check the connection of the pacemaker. Check the connection of electrodes and lead wires. Check the current situation of the patient.
"ECG LEAD OFF"	ECG lead is not connected correctly.	Check the connection of ECG lead wire.
"ECG V LEAD OFF";	The V lead wire of ECG is not connected correctly.	Check the connection of V lead wire.
"ECG LL LEAD OFF";	The LL lead wire of ECG is not connected correctly.	Check the connection of LL lead wire.
"ECG LA LEAD OFF";	The LA lead wire of ECG is not connected correctly.	Check the connection of LA lead wire.
"ECG RA LEAD OFF";	The RA lead wire of ECG is not connected correctly.	Check the connection of RA lead wire.
"ECG C LEAD OFF";	The C lead wire of ECG is not connected correctly.	Check the connection of C lead wire.
"ECG F LEAD OFF";	The F lead wire of ECG is not connected correctly.	Check the connection of F lead wire.
"ECG L LEAD OFF";	The L lead wire of ECG is not connected correctly.	Check the connection of L lead wire.
"ECG R LEAD OFF";	The R lead wire of ECG is not connected correctly.	Check the connection of R lead wire.

SPO2 SENSOR OFF	SpO_2 sensor may be disconnected from the patient or the monitor.	Make sure that the monitor and the patient are in correct connection with the cables.
SPO2 INIT ERR	SpO_2 module failure	Stop using the measuring function of SpO_2 module, notify biomedical engineer or Our service staff.
SPO2 INIT ERR 1		
SPO2 INIT ERR 2		
SPO2 INIT ERR 3		
SPO2 INIT ERR 4		
SPO2 INIT ERR 5		
SPO2 INIT ERR 6		
SPO2 INIT ERR 7		
SPO2 INIT ERR 8		
SPO2 COMM STOP	SpO_2 module failure or communication error	Stop using the measuring function of SpO_2 module, notify biomedical engineer or Our service staff.
SPO2 COMM ERR	SpO_2 module failure or communication error	Stop using the measuring function of SpO_2 module, notify biomedical engineer or Our service staff.
SPO2 ALM LMT ERR	Functional safety failure	Stop using the measuring function of SpO_2 module, notify biomedical engineer or Our service staff.
PR ALM LMT ERR	Functional safety failure	Stop using the measuring function of SpO_2 module, notify biomedical engineer or Our service staff.
MASIMO Alarm information:		
SpO2 NO SENSOR	This message is displayed when the sensor is not connected to monitor	Make sure that the monitor and the patient are in correct connection with the cables.
SpO2 SENSOR OFF	SpO2 sensor may be disconnected from the patient or the monitor.	Make sure that the monitor and the patient are in correct connection with the cables.
SpO2 SENSOR FAULT	This message appears when the sensor is faulty or finding unrecognized sensor, incompatible sensor connected	Stop using the measuring function of SpO2 module, notify biomedical engineer or Our service staff.
SpO2 UNRECOGNIZED SENSOR	This message is displayed when the Masimo board does not recognize the sensor.	Make sure that the monitor and the patient are in correct connection with the cables.
SpO2 INTERFERENCE	This message is displayed when noise is detected on the	Make sure that the monitor and the patient are in correct

	pulse signal preventing pulse discrimination from the noise. The message is removed when the noise is removed.	connection with the cables.
SpO2 PULSE SEARCH	This message is displayed when the hardware settings are being adjusted in order to discriminate a pulse waveform. The message is removed when a pulse waveform is detected.	Make sure that the monitor and the patient are in correct connection with the cables.
SpO2 LOW PERFUSTION	This message is displayed when patient perfusion is low, at the same time, the spo2 value is displayed if the host received the value from board .	Make sure that the monitor and the patient are in correct connection with the cables.
SpO2 TOO MUCH LIGHT	This message is displayed when there is too much ambient light to take a measurement.	
SpO2 LOW SIGNAL IQ	This message is displayed when the signal quality is too low.	Make sure that the monitor and the patient are in correct connection with the cables.
SpO2 BOARD FAULT	This message appears when the Masimo Set board malfunctions.	Stop using the measuring function of SpO2 module, notify biomedical engineer or Our service staff.
SpO2 COMMUNICATION ERROR	This message is displayed when the front end module is having problems communicating (ie: framing errors or bad checksums) with the Masimo board.	Stop using the measuring function of SpO2 module, notify biomedical engineer or Our service staff.
SpO2 COMMUNICATION STOP	This message is displayed when the host can not receive the data from Masimo board for 5 seconds	Stop using the measuring function of SpO2 module, notify biomedical engineer or Our service staff.
SpO2 INIT ERR	This message is displayed when the SpO2 module initialization error happened.	Stop using the measuring function of SpO2 module, notify biomedical engineer or Our service staff.
"TEMP1 SENSOR OFF"	TEMP1 sensor is not connected correctly.	Check the connection of TEMP1 sensor.
"TEMP2 SENSOR OFF"	TEMP2 sensor is not connected correctly.	Check the connection of TEMP2 sensor.
"IBP1 LEAD OFF"	IBP1 sensor is not connected correctly.	Check the connection of IBP1 sensor.
"IBP2 LEAD OFF"	IBP2 sensor is not connected correctly.	Check the connection of IBP2 sensor.
"IBP1 NEED ZERO-CAL"	Zero calibrating must be done before measuring in IBP1	Do zero calibrating for IBP1
"IBP2 NEED ZERO-CAL"	Zero calibrating must be done before measuring in IBP2	Do zero calibrating for IBP2

"TB SENSOR OFF"	TB sensor is not connected correctly.	Check the connection of TB sensor.
"CO2 SENSOR OFF"	CO2 sensor is not connected correctly.	Check the connection of CO2 sensor.
"ECG NOISE"	Rather large interference signals appear in the ECG signals.	Check the connection of ECG lead wire. Check the current situation of the patient. Check if the patient moves a lot.
"XX INIT ERR X"	XX has error X during initialization.	Re-start up the monitor or re-plug in/out the module. If the error still exists, contact the manufacturer.
"XX COMM STOP"	XX cannot communicate with the host.	
"XX COMM ERR"	XX cannot communicate normally with the host.	
XX represents all the parameter modules in the system such as ECG, NIBP, SpO2, IBP, CO module, etc.		
"XX ALM LMT ERR"	The alarm limit of XX parameter is modified by chance.	Contact the manufacturer for repair.
"XX RANGE EXCEEDED"	The measured value of XX parameter has exceeded the measuring range of the system.	Contact the manufacturer for repair.
XX represents the parameter name in the system such as HR, ST1, ST2, RR, SpO2, IBP, NIBP, etc.		
"CO2 NO WATERTRAP"	CO2 watertrap is not connected correctly.	Check the connection of CO2 watertrap.
"CO2 WATERTRAP OCCLUDE"	CO2 watertrap is clogged.	Replace the filter net or CO2 air hose. Check if the water in the CO2 watertrap is too much.
"CO2 SIGNAL LOW"	CO2 signals are poor.	Check for leaks in the airway. Check if the airway is clogged. Check if the watertrap is too old. After excluding the above problems, replace another CO2 air hose or watertrap. If it still cannot work normally, contact the manufacturer for repair.
"CO2 SIGNAL TOO LOW"	CO2 signals are too poor.	
"CO2 BAROMETRIC TOO LARGE"	CO2 modules has failure.	Contact the manufacturer for repair.
"CO2 PNEUMATIC LEAK"		
"CO2 SIGNAL NOISY"		
"CO2 SIGNAL SATURATE"		
"CO2 CALCULATION ERR"		
"CO2 PUMP FAULT"		
"CO2REVERSE FLOW"		
"CO2 FORWARD FLOW"		
"CO2 MALNUFUNCTION"		
"CO2 BAROMETRIC HIGH"		
"CO2 BAROMETRIC LOW"		

"CO2 WATCHDOG ERROR"		
"CO2 INT COMM ERR"		
“CO2 SYSTEM ROM ERR”		
“CO2 FLASH CRC ERR”		
“CO2 EXT RAM ERR”		
“CO2 INT RAM ERR”		
“CO2 FLASH CHECK ERR”		
“CO2 STACK OVER”		
"CO2 SENSOR FAULT"		
"CO2 SENSOR TEMP HIGH"		
"CO2 SENSOR TEMP LOW"		
"REAL CLOCK NEEDSET"	When the system displays 2000-1-1, the system gives this prompt reminding the user that the current system time is not right.	Re-set up the system time. It is better to set up the time just after the start-up and prior to monitoring the patient. After modifying the time, the user had better re-start up the monitor to avoid storing error time.
"REAL CLOCK NOT EXIST"	The system has no cell battery or the battery has run out of the capacity.	Install or replace the rechargeable battery.
"SYSTEM WD FAILURE"	The system has serious error.	Re-start up the system. If the failure still exists, contact the manufacturer.
"SYSTEM SOFTWARE ERR"		
"SYSTEM CMOS FULL"		
"SYSTEM CMOS ERR"		
"SYSTEM EPGA FAILURE"		
"SYSTEM FAILURE2"		
"SYSTEM FAILURE3"		
"SYSTEM FAILURE4"		
"SYSTEM FAILURE5"		
"SYSTEM FAILURE6"		
"SYSTEM FAILURE7"		
"SYSTEM FAILURE8"		
"SYSTEM FAILURE9"		
"SYSTEM FAILURE10"		
"SYSTEM FAILURE11"		
"SYSTEM FAILURE12"		
"KEYBOARD NOT AVAILABLE";	The keys on the keyboard cannot be used.	Check the keys to see whether it is pressed manually or by other object. If the key is not pressed abnormally, contact the manufacturer for repair.
"KEYBOARD COMM ERR";	The keyboard has failure, which cannot be used.	Contact the manufacturer for repair.
"KEBOARD ERROR";		
"KEYBOARD ERR1";		
"KEYBOARD ERR2";		
"NET INIT ERR(G.)"	The network part in the system has failure. The system cannot be linked to the net.	Contact the manufacturer for repair.
"NET INIT ERR(Ram)"		
"NET INIT ERR(Reg)"		

"NET INIT ERR(Mii)"		
"NET INIT ERR(Loop)"		
"NET ERR(Run1)"		
"NET ERR(Run2)"		
"NET ERR(Run3)"		
"5V TOO HIGH"	The power part of the system has failure.	If the prompt appears repeatedly, contact the manufacturer for repair.
"5V TOO LOW"		
"POWER ERR3"		
"POWER ERR4"		
"12V TOO HIGH"		
"12V TOO LOW"		
"POWER ERR7"		
"POWER ERR8"		
"3.3V TOO HIGH"		
"3.3V TOO LOW"		
"CELL BAT TOO HIGH"	Cell battery has problem.	Replace the battery. If the failure still exists, contact the manufacturer.
"CELL BAT TOO LOW"	The cell battery has low capacity or the cell battery is not installed or the connection is loose.	
"RECORDER SELFTEST ERR"	During the self-test, the system fails connecting with the recorder module.	Execute 'Clear Record Task' function in the recorder setup menu to re-connect the host and the recorder. If the failure still exists, contact the manufacturer for repair.
"RECORDER VLT HIGH"	The recorder module has voltage failure.	Contact the manufacturer for repair.
"RECORDER VLT LOW"		
"RECORDER HEAD HOT"	The continuous recording time may be too long.	After the recorder becomes cool, use the recorder for output again. If the failure still exists, contact the manufacturer for repair.
"REC HEAD IN WRONG POSITION"	The handle for pressing the paper is not pressed down.	Press down the recorder handle for pressing the paper.
"RECORDER OUT OF PAPER"	No paper is in the recorder.	Place the paper into the recorder.
"RECORDER PAPER JAM"	The paper in the recorder is jammed.	Place the recorder correctly and try again.
"RECORDER COMM ERR"	The communication of the recorder is abnormal.	In the recorder setup menu, execute the function of clearing record task. The function can make the host and the recorder connect again. If the failure still exists, contact the manufacturer for repair.
"RECORDER S. COMM ERR"		
"RECORDER PAPER W.P."	The paper roll of the recorder is not placed in the correction position.	Place the paper roll in the correct position.
"REC NOT AVAILABLE"	Cannot communicate with the recorder.	In the recorder setup menu, execute the function of clearing record task. The function can make the host and the recorder connect again. If the failure still exists, contact the manufacturer for repair.

"NIBP INIT ERR"	NIBP initialization error	Execute the reset program in the NIBP menu. If the failure still exists, contact the manufacturer for repair.
"NIBP SELFTEST ERR"		
"NIBP ILLEGALLY RESET"	During NIBP measurement, illegal reset occurs.	Check the airway of NIBP to see if there are clogs. Then measure again, if the failure still exists, contact the manufacturer for repair.
"NIBP COMM ERR"	The NIBP communication part has problem.	Execute the reset program in the NIBP menu. If the failure still exists, contact the manufacturer for repair.
"LOOSE CUFF"	The NIBP cuff is not connected correctly.	Re-connect the NIBP cuff.
"AIR LEAK"	The NIBP cuff is not connected correctly or there are leaks in the airway.	Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"AIR PRESSURE ERROR"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"WEAK SIGNAL"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check if the setup of patient type is correct. Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair
"RANGE EXCEEDED"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"EXCESSIVE MOTION"	The patient arm moves.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"OVER PRESSURE"	Perhaps folds exist in the airway.	Check for the smoothness in the airway and patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"SIGNAL SATURATED"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"NIBP TIME OUT"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"CUFF TYPE ERR"	Perhaps the used cuff does not fit the setup patient type.	Check if the patient type is set up correctly. Check the connection of each part or

		replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"PNEUMATIC LEAK"	NIBP airway has leaks.	Check the connection of each part or replace with a new cuff. If the failure still exists, contact the manufacturer for repair.
"MEASURE FAIL"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
"NIBP SYSTEM FAILURE"	Problem happens when measuring the curve. The system cannot perform measurement, analysis or calculation.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
AG NO WATERTRAP	The AG watertrap falls off from the monitor.	Check the connection of AG watertrap sensor.
CHANGE AG WATERTRAP	Replace the AG watertrap	Check if the watertrap type is correct. Check the connection of each part or replace with a new watertrap. If the failure still exists, contact the manufacturer for repair.
AG WATERTRAP TYPE WRONG	The type of the AG watertrap being used is not suitable.	
AG INIT FAIL	AG module has failure.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
AG COMM STOP	AG module failure or communication failure	
AG OCCLUSION	The actual PUMP rate of the AG module is <20ml/min, which exceeds 1 second.	Refer to the chapter of “Maintenance and Cleaning” of the “Anesthetic Gas Measurement” in this operation manual.
AG COMM ERROR	AG module has communication failure.	Check the connection of each part and the patient situation. Measure again, if the failure still exists, contact the manufacturer for repair.
AG HARDWARE ERROR	AG module has hardware failure.	
AG DATA LIMIT ERROR	AG module failure	
AG USA ERROR	AG module failure	
AG ZREF FAIL	AG module fails to zero.	
AG CAL FAIL	AG module fails to calibrate.	
FiCO2 ALM LMT ERR	Functional safety failure	
EtCO2 ALM LMT ERR	Functional safety failure	
FiO2 ALM LMT ERR	Functional safety failure	
EtO2 ALM LMT ERR	Functional safety failure	
FiN2O ALM LMT ERR	Functional safety failure	
EtN2O ALM LMT ERR	Functional safety failure	
FiAA ALM LMT ERR	Functional safety failure	
EtAA ALM LMT ERR	Functional safety failure	
AwRR ALM LMT ERR	Functional safety failure	

APPENDIX B
INSTRUCTION OF FIXING KIT

B.1. Instruction of Mounting Cart Stand

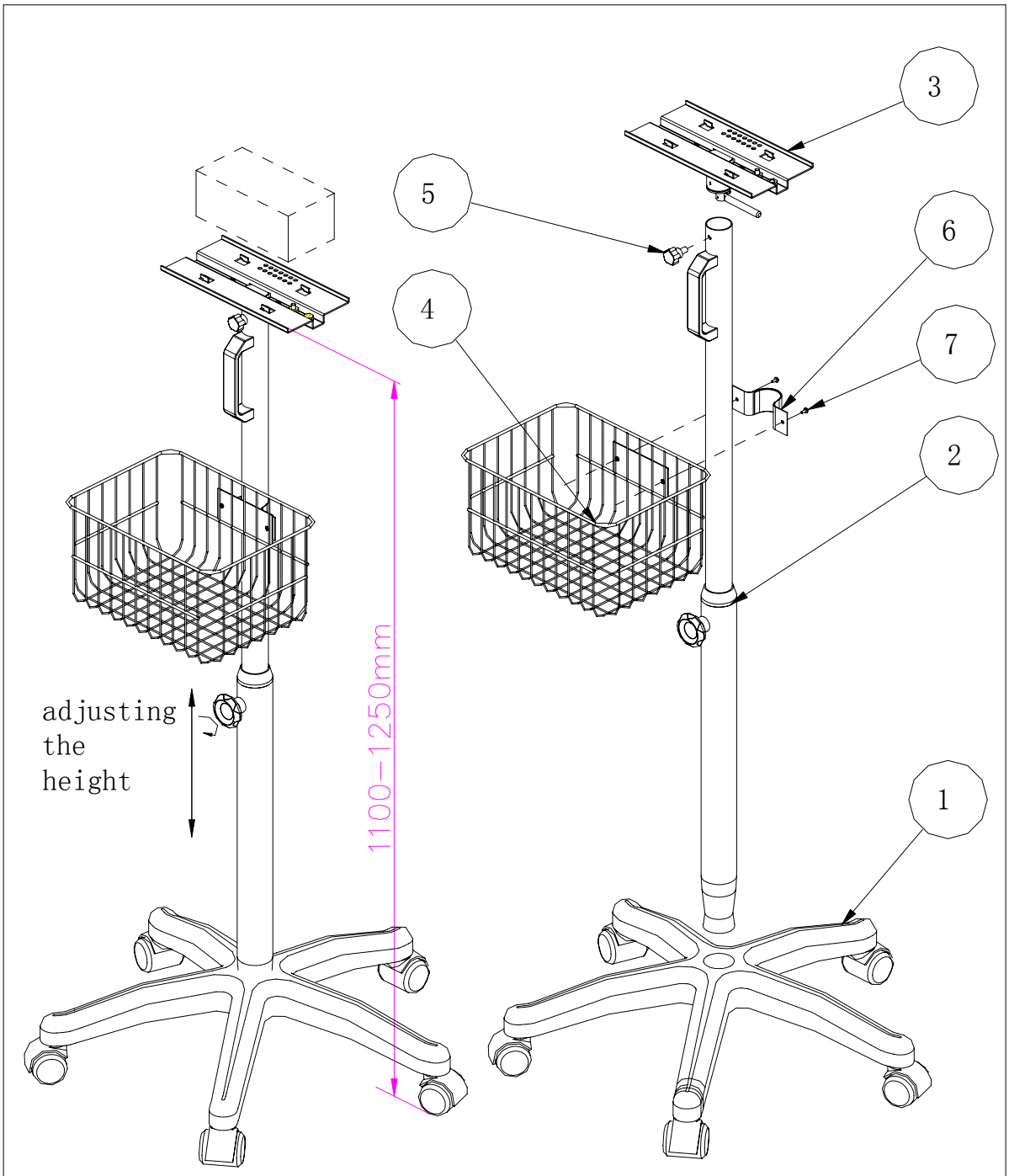
This instruction can be used as the guidance for mounting the cart stand of PM-8000, PM-9000, MEC-509B and PM-6000.

B.1.1 Mounting the stand

1) Insert the stand-pole assembly of the cart into the cone-shaped hole on the center of the base to inhibit the stand-pole from moving. (See figure B-1)
2) Adjust the mounting plate assembly of the cart to an elevated angle. Then use rotary spanner to turn the lock screw securely. (See figure B-2)
3) Insert the mounting plate assembly into the pipe of the upper stand-pole. Use the spanner to firmly and securely fix the mounting plate assembly and the upper stand-pole together. (See figure B-1)
4) Fix the press plate of the basket and the small clamp onto the upper stand-pole. Then use M3x8 cross panhead screw to firmly and securely fix the press plate and the clamp together. (See figure B-1). The distance from top of the basket to the mounting plate is recommended to be 0.25~0.45m.
5) Adjust the height: loosen the ripple handle, the upper stand-pole can move up and down. After adjusting the height of the stand-pole, turn the ripple handle to fix the upper stand-pole firmly. (See figure B-1)

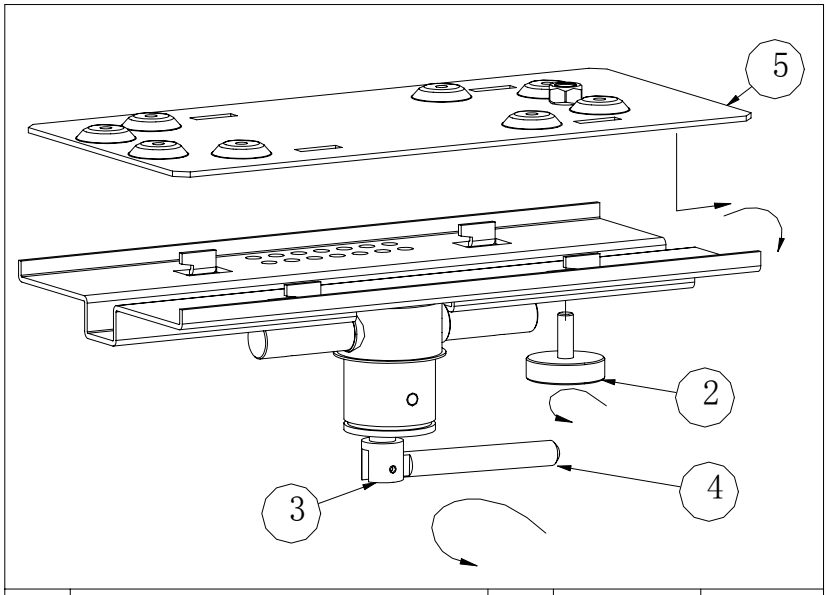
B.1.2 Mounting monitor

1) Insert the stud screw into the threaded hole on the bottom of the monitor (including PM-8000, PM-9000, MEC-509B and PM-6000) and fix it securely (remove the screw in the bottom of the PM9000). Then use M4x6 cross panhead screws with washer to mount the monitor onto the supporting board of the adapter plate. (See figure B-3)
2) Mount the adapter plate and the monitor onto the mounting plate. Turn the stop knob below the mounting plate to lock the adapter plate securely. (See figure B-2)



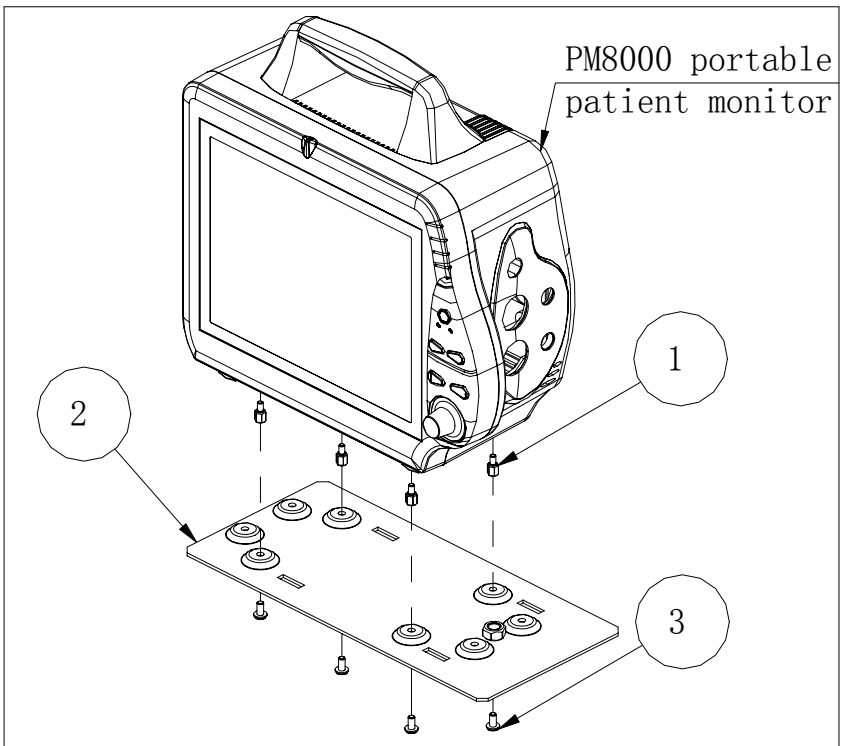
NO.	Name & Specification	QUAN.	Material	Remarks
7	spanner type B M5x4	1		
6	cross panhead screw with washer M3x8	2		
5	small clamp	1		
4	basket	1		
3	mounting plate Assembly	1		
2	cart stand Assembly	1		
1	arm	1	Al alloy	

Figure B-1 Mounting the bracket of the cart stand of PM8000, PM9000, MEC509B



No.	Name & Specification	Quan.	Material	Remarks
5	monting bracket	1	SPCC δ=2	
4	spanner	1	LY12	
3	lock screw	1	LY12	
2	stop knob	1	LF21	
1	mounting plate assembly	1		

Figure B-2 Mounting the adapter plate and adjusting the elevated angle of the mounting plate



No.	Name & Specification	Quan.	Material	Remarks
3	cross panhead screw with washer M4x6	4		
2	mounting bracket	1	SPCC δ=2	
1	stainless steel screw M4x6	4		

Figure B-3 Connecting the adapter plate and the monitor together

(**use PM-8000 as an example**)

Appendix：

Specifications of Cart Stand

Applicable device	PM6000, PM8000, PM9000, MEC509B
Height of cart stand	1.1m~1.25m(basket is installed at the recommended position)
Angle of altitude of the card mounting plate	±10°
Specifications of the foot	radius is R320mm
specifications of the lower stand-pole	Φ50.8mm
specifications of the upper stand-pole	Φ38mm
stability	incline for 10° without loosing balance (maximum device weight that the stand can sustain is 10kg)

B.2 Instruction of Mounting Hook Bracket

B.2.1Mounting bracket (use PM-8000 as an example)

See figure B-4, there are three screw holes on the rear panel of the portable patient monitor (such as PM-8000 and PM-9000). Take three M3X12 screws with washer to fix the bracket firmly onto the rear panel of the portable patient monitor.

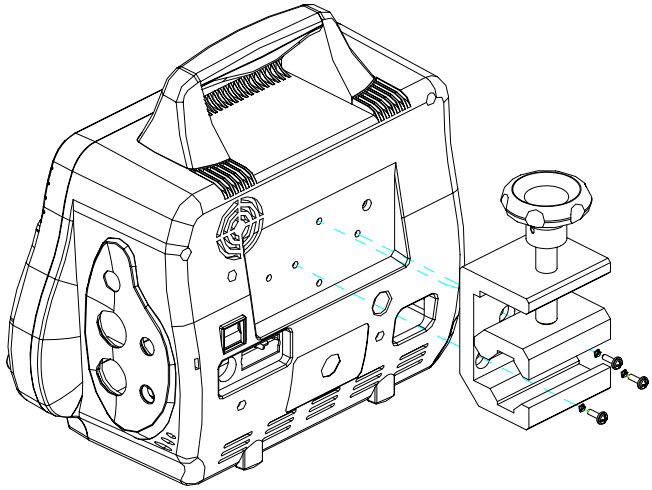


Figure B-4

B.2.2 Mounting monitor

As shown in figure B-5, the monitor with bracket can be mounted onto various kinds of horizontal pipes. Turn the handle on the lock bracket to loosen the bracket. Use the “V” groove of the bracket to hold the horizontal pipe and then turn the handle on the lock bracket firmly until the monitor can no longer move.

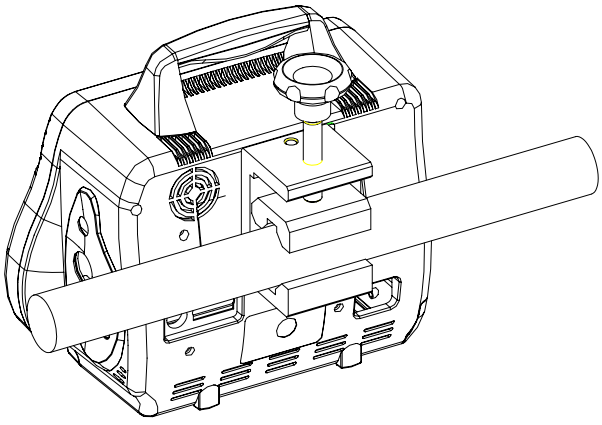


Figure B-5

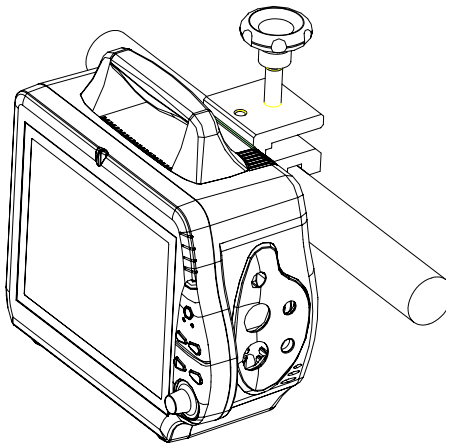


Figure B-6

Appendix：

Specifications of Hook Bracket

Applicable device	PM8000, PM9000
Size of horizontal pipe	ϕ 25~ ϕ 40
Dimensions（MM）	65X55X160

B.3 Instruction of Mounting Simplified Hook Bracket

B.3.1 Mounting bracket (use PM-8000 as an example)

See figure B-7, there are five holes on the rear panel of the portable patient monitor (such as PM-8000 and PM-9000). Take five M3×12 screws with washer to fix the bracket firmly onto the rear panel of the portable patient monitor.

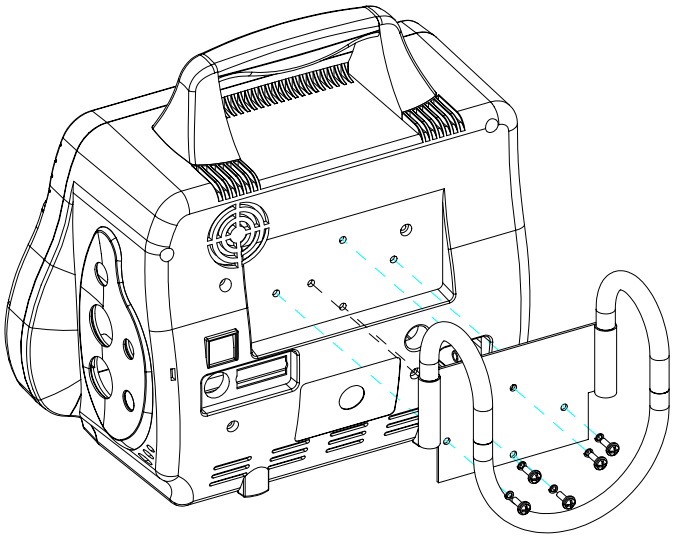


Figure B-7

B.3.2 Mounting monitor

As shown in figure B-8, the monitor with bracket can be mounted onto the horizontal pipe beside the sick bed. For simplified bracket, you can push it left or right. When the bracket is in the correct position, hang the monitor onto the horizontal pipe beside the sick bed.

Note: The rear lower part of the monitor must lean against the edge of the bed or the stand-pole beside the bed. Otherwise, the monitor may circle around the horizontal pipe. When not using the simplified bracket, push it to one side of the monitor as shown in figure B-9 to save space.

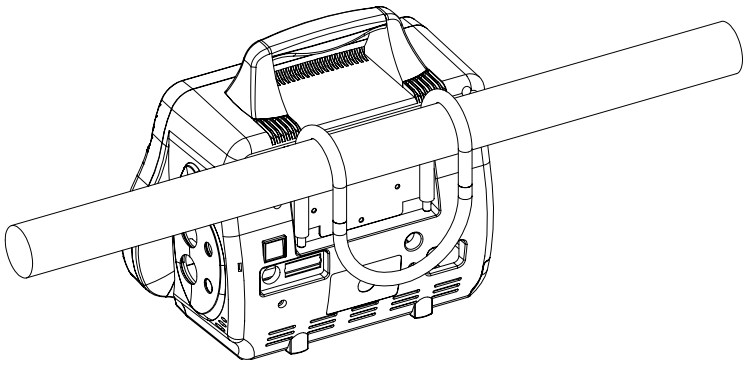


Figure B-8

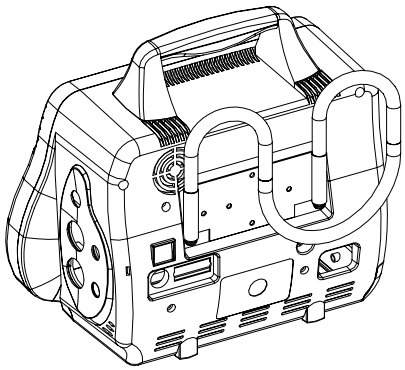


Figure B-9

Appendix:

Specifications of Simplified Hook Bracket

Applicable device	PM8000, PM9000
Size of horiontal pipe	φ25~ φ45
Dimensions（MM）	114X65X115（after being folded114×20×115）

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